South Carolina Department of Natural Resources

Waterfowl Project Report

2003-04 2004-05

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INTRODUCTION

Waterfowl are an highly regarded, sought after and economically important resource in SC. Hunting waterfowl and management of wetland habitats across the state on both private and public domains create controversy and misunderstanding because ducks and geese wintering in SC are migratory.

Further, interaction of many variables influences waterfowl abundance and enjoyment. Large populations of waterfowl historically migrated through and into SC during winter months to exploit abundant, high quality habitat along rivers, lakes and coastal marshes from October through March each year. Migratory waterfowl mix with local populations of resident Canada Geese, wood ducks and mottled ducks during this period. Waterfowl are a dynamic resource adapting to annual weather cycles, new or enhanced habitats, and disturbance across the continent, within the flyways, and in SC. Because waterfowl are a mobile, continental resource their stewardship and management involves DNR staff involvement in regulatory and administrative interaction with state, provincial and Federal agencies, as well as annual monitoring of population and harvest status within SC and the Atlantic Flyway (AF). This report addresses various facets of waterfowl regulations, survey, production, habitat management and public waterfowl hunting opportunities in SC over a 2-year administrative period, 2003-04 and 2004-05.

REGULATIONS

The SC waterfowl hunting seasons of 2003-04 and 2004-05 were set by the DNR Board in accordance with the Federal migratory bird-hunting framework pursuant to approval by the United States Fish and Wildlife Service (FWS) on the basis of recommendations by the Atlantic Flyway Council (AFC). Final recommendations from the AFC to FWS have been based in recent years on an Adaptive Harvest Management (AHM) model annually evaluating mallard production and habitat. AHM modeling in both years allowed liberal harvest opportunities (60 days) in the AF.

The DNR Board approved a 50-day waterfowl hunting season in SC in each year for several reasons, including but not limited to: (1) fewer days were recommended and selected based on concern for the migratory waterfowl resource wintering in SC pursuant to decreasing trends in wintering numbers of several species, (2) there is understanding and agreement among waterfowl biologists, both in SC as well as in other states, that migratory waterfowl wintering in SC are not adequately related to AHM decision criteria used to produce liberal harvest opportunities, and (3) there was support for conservatism among hunters and constituent group representatives as expressed to the DNR Waterfowl Advisory Committee (WAC) and DNR Board.

SC waterfowl hunting regulations during both 2003-04 and 2004-05 included 50 days of hunting with a basic limit of 6 ducks; internal daily limits were placed on several species including wood ducks (2), redheads (2), fulvous tree duck (1), scaup (3), and mallards (4). Additionally only 1 mallard hen or 1 black duck or 1 mottled duck could be taken per day. During 2004-05 an additional species was added to the daily bag with a limit on black-bellied tree ducks of 1 per day. One Northern pintail was allowed during the first 30 days of the season

in 2003-04 and during the last 30 days of the season in 2004-05. One canvasback was allowed during the last 30 days of both seasons. A total of 5 blue or snow geese were allowed per day during 2003-04; during 2004-05 the blue or snow goose limit was increased to 15 per day. During both years a total of 5 Canada geese were allowed per day with restrictions on areas for Canada goose hunting to protect the migratory component of this species.

The waterfowl-hunting season during both years was extended through the last Sunday in January, and a 2-day special season scheduled approximately a week after the primary season was allowed for youth 15 years old and younger.

MID-WINTER SURVEYS

Surveys of waterfowl are conducted across the continent for specific population management purposes at various periods each year. Survey efforts provide estimated numbers of waterfowl for year-to-year trend analysis. These include a mid-winter survey (MWS) tabulation of waterfowl by species conducted by cooperating Federal, state, and private personnel from ground, by watercraft and aircraft on and over traditional wintering habitats. These surveys do not provide an estimate of the numbers of waterfowl wintering in any state or survey unit during a given year or at a prescribed point in time. Further these surveys are subject to various errors which cooperating personnel strive to minimize in order to sustain validity of survey data for comparative purposes. Tables I and II provide MWS survey data for the past 2 years compared to the 5-year trend in SC and the 10-year trend in the AF. Figures 1-4 provide results and historical trend analysis of MWS efforts in SC and AF for ducks and geese from 1964-2005.

SC MWS dabbling duck numbers increased (+59.2%) in 2004 from 2003 and were substantially higher (+62.7%) than the average during 1999-2003. In 2005 dabbler numbers decreased (-24.7%) from 2004, but remained 11.4% above the average during 2000-2004. Green-winged teal and Northern pintail numbers demonstrated the most dramatic improvement with green-winged teal numbers climbing 90.5% in 2004 from 2003, dropping 16.8% in 2005, but remaining 52.4% above the average during 2000-04. Northern pintail MWS numbers were 71.6% and 38.4% above the averages of the 5-year periods preceding 2004 and 2005 respectively. Improvement in wintering Northern pintail numbers may be related to recent pro-active season length and bag limit restrictions benefiting this species. MWS diving duck numbers fluctuate from year-to-year due to weather, habitat related distribution, visibility, survey conditions and other factors. Diving ducks numbers revealed by MWS increased (+14.4%) in 2004 and decreased (-24.8%) in 2005 from preceding years. MWS goose numbers in SC remain low but demonstrated overall improvement increasing 12.7% in 2004 and 4.4% in 2005 as compared to the respective

averages of the preceding 5-year periods; increases in snow goose numbers in both years accounted for increases.

AF MWS dabbling duck numbers increased 11.9% in 2004 from 2003 but were slightly below (-1.9%) the 10-year average from 1994-03. Dabbler numbers decreased (-22.9%) in 2005 from 2004 and were 25.2% below the 10-year average during 1995-04. AF diving duck numbers increased (+22.7%) in 2004 and decreased (-14.5%) during 2005 from preceding years, but in both years decreased (-18.3% and -36.8%) from the respective averages of the 10-year preceding periods. MWS goose numbers in the AF during 2004 were 18.9% above the long-term average but declined (-0.1%) in 2005 from average goose estimates during 1995-04.

WILDLIFE MANAGEMENT AREAS

Habitat Management, Waterfowl Utilization and Public Waterfowl Hunting on Category I Areas

Category I Waterfowl Areas include all WMAs specifically, or in part, managed for waterfowl where hunters are selected by annual random drawing. These include Beaverdam Creek and Clemson Waterfowl WMAs in DNR Region 1; Broad River WMA in Region 3; and Bear Island, Donnelley, Samworth, Sandy Beach, Santee Coastal Reserve, and Santee-Delta WMAs in Region 4. Tables III and IV provide summaries of public waterfowl hunting opportunity and success on Category I Waterfowl Areas during the respective 2003-04 and 2004-05 waterfowl hunting seasons. Figure 6 demonstrates annual waterfowl harvest/hunter/day on all areas during the period 1969-70 through 2004-05.

A total of 64 and 66 regular drawing waterfowl hunts and a total of 11 and 9 youth/adult waterfowl hunts were conducted on Category I Areas during the respective 2003-04 and 2004-05 waterfowl hunting seasons. A total of 9 youth only waterfowl hunts were conducted on these areas during each of the respective hunting seasons. During the 2-year period a total of 168 waterfowl hunt events were conducted on Category I Areas.

Habitat management at the 35-acre Beaverdam Creek WMA consisted of planting approximately 6 acres to corn both years; the remainder of this area was managed for moist-soil plants. Above average rainfall in 2003 resulted in a fair crop of corn, and favorable growing conditions in 2004 resulted in good corn production. Waterfowl utilization on this area was characterized as below average in 2003-04, but hunting participants were successful averaging 2.48 ducks/hunter with ring-necked ducks comprising 66.7% of the bag. Waterfowl utilization at Beaverdam Creek WMA was poor in 2004-05 as was the entire upstate region, and waterfowlers averaged 1.12 ducks/hunter with 57.9% of the harvest consisting of wood ducks. Clemson Waterfowl WMA is an 11-acre area

reserved for adult/youth paired hunting. None of the area could be planted in 2003 due to flooding; 7 acres were planted to corn and 2 acres were planted to chufa in 2004. Crops were considered to have been excellent in 2004; despite effort and habitat there was limited duck utilization on this area.

Broad River WMA habitat management consisted of planting corn and managing for moist-soil emergent plants. Flooding in 2003 precluded crop production. An excellent crop of corn in 2004 was ruined by tropical weather the rainfall from which also breached dikes on the area. Participants averaged 2.93 and 2.29 ducks/hunter respectively during waterfowl hunts conducted on Broad River WMA during 2003-04 and 2004-05. Mallards (28.8%), wood ducks (20.5%) and ring-necked ducks (20.5%) comprised leading species in the bag during 2003-04. Ring-necked ducks (21.8%), green-winged teal (18.2%) and wood ducks (18.2%) were the top species harvested in 2004-05.

Samworth WMA is an area consisting of 802 acres of managed tidal freshwater wetlands in 13 management units. Samworth WMA was not included in the regular draw hunt program during a 3-year period prior to 2004-05 pursuant to requests from public hunters and adjacent landowners in order to limit disturbance, to maximize opportunity for hunters using public waters around the area, and to foster and maintain waterfowl fidelity to the area. Waterfowl habitat on the area has been affected by natural perturbations (flooding and tropical weather) and vandalism; however, most habitat was in prime condition during both 2003 and 2004. Wintering waterfowl utilization of the area during 2003-04 and 2004-05 was excellent. Draw hunts were conducted on Samworth during 2004-05 with participants harvesting an average of 3.04 ducks/hunter. Green-winged teal and wood ducks respectively comprised 57.5% and 32.8% of the bag.

Each year a large number of waterfowl hunters utilize public waters immediately adjacent to Samworth WMA managed wetlands. DNR staff surveyed public hunting opportunity from 1983-84 through 2003-04; an estimated minimum average of 1,289 waterfowl hunters per year hunted adjacent to this area during the 21-year period (Table V, Figure 5). During 2003-04 an estimated minimum of 1,664 waterfowlers hunted in public waters immediately adjacent to Samworth WMA.

Sandy Beach WMA, located adjacent to and intricately linked to Lake Moultrie, was managed for a variety of planted crops during both years. Proximity to Lake Moultrie renders the area difficult to manage for moist-soil plants due to water level fluctuations. Growing conditions were good during 2003 resulting in approximately 40 acres of successful agricultural plantings, including brown-top and Japanese millets and chufas. Waterfowl response to habitat management was in accordance with expectations during 2003-04, and participants averaged 2.75 ducks/hunter with wood ducks (30.0%), mallards (24.3%) and green-winged teal (22.1%) comprising most of the bag. Excess

precipitation and armyworms arrested habitat management efforts in 2004, but good waterfowl utilization of the area permitted an average of 2.98 ducks/hunter during 2004-05. Mallards (34.4%), wood ducks (27.0%) and green-winged teal (19.7%) were top species in the bag.

Santee Coastal Reserve (SCR) is the largest of all DNR areas where waterfowl management is emphasized. Extensive brackish managed wetlands occur on Cedar and Murphy islands, which are barrier islands, and The Cape, a mainland management unit. Approximately 14,000 acres on this area are managed for high-quality submerged and emergent plants favored by waterfowl. Waterfowl habitat on The Cape was in excellent condition during growing seasons of both 2003 and 2004 while habitat conditions on Murphy Island was considered average during both years. On Cedar Island habitat conditions were below average in 2003 and excellent in 2004. The extensive wetlands on SCR annually provide foraging and refuge habitat for large concentrations of wintering waterfowl, and hunting success typically is high. During 2003-04 waterfowl hunting participants averaged 4.75 ducks/hunter with 22.7% of the harvest comprised of blue-winged teal. Green-winged teal (18.3%), gadwall (12.3%) and wigeon (12.0%) were the additional most important species harvested. Blue-winged teal (19.5%), gadwall (18.6%), green-winged teal (16.1%) and Northern shovelers (14.4%) were leading species harvested in 2004-05 when participants averaged 3.87 ducks/hunter on this area.

Santee-Delta WMA is a vital area for the remaining migratory mallards wintering in SC. The area consists of 1,135 acres of freshwater managed wetlands between the North and South Santee rivers. Habitat management conditions during 2003 were less than ideal as the area remained inundated until late in the growing season due to flooding of the Santee River, however, habitat management efforts produced a late crop of preferred emergent plants resulting in high waterfowl utilization during the ensuing wintering period with excellent public hunting opportunities. Participants averaged 3.33 ducks/hunter with green-winged teal (32.8%) and mallards (25.2%) comprising the majority of the bag. Habitat management was facilitated during 2004 by ample freshwater and predictable tides resulting in excellent habitat conditions. During the winter period of 2004-05 impressive waterfowl concentrations utilized the area, and hunters benefited by averaging 2.27 ducks per/hunter even though there was a 16.9% increase in hunter numbers from 2003-04. During 2004-05 green-winged teal (34.1%) and mallards (17.0%) were the most important species in the bag.

Waterfowl hunting at Bear Island WMA has a long and rich tradition. This area includes 5,385 acres of brackish and fresh managed wetlands in the Bear Island East, Bear Island West and Springfield/The Cut units. Habitat management during 2003 was much improved over conditions during the preceding 2 years when extreme drought affected the area with prolonged high salinity. A return to more average rainfall in 2004 further improved habitat at Bear Island WMA, and late season tropical rainfall provided opportunities for both

freshwater and brackish wetlands to be in excellent condition. DNR staff planted approximately 15 acres to corn in 2004 with success. Waterfowl utilization in 2003-04 was considered below average despite improved habitat. Waterfowl hunt participants averaged 1.64 and 2.16 ducks/hunter on Bear Island and Springfield/The Cut units respectively, with blue-winged teal (24.3%) being the most important bird in the bag on Bear Island and green-winged teal (20.4%) leading the bag on Springfield/The Cut. Waterfowl responded to habitat improvements in 2004-05 and hunting success improved on both Bear Island (1.85 ducks/hunter) and Springfield/The Cut (3.53 ducks/hunter) units. As in the previous year blue-winged teal (24.1%) and green-winged teal (23.3%) were the most important ducks in the bag respectively on Bear Island and Springfield/The Cut units.

Youth/adult waterfowl hunts are featured at Donnelley WMA, a diverse area supporting high quality freshwater and brackish managed wetlands. Habitat management for moist-soil plants was considered average in 2003 and excellent in 2004. In both years approximately 45 acres were planted to corn for winter flooding. Waterfowl utilization was consistently good during both wintering periods. Participating adults and youth averaged 2.91 ducks/hunter during 2004-05 as wood ducks and green-winged teal comprised 34.4% and 25.3% respectively of the total harvest. Adult/youth harvest statistics are provided in Table VI along with summaries of results on Category I and II areas.

Habitat Management, Waterfowl Utilization and Waterfowl Hunting on Category II Areas

A total of 22 sites across SC comprise DNR Category II Waterfowl Management Areas. Typically waterfowl habitat management on these sites is less intensive, however, areas such as Russell Creek, Enoree and Hickory Top WMAs are intensively managed. Category II Areas are available for public waterfowl hunting on specific days and times during the open hunting season for waterfowl. Public use and waterfowl harvest data are collected on a limited number of Category II Areas including Crackerneck WMA on the US Department of Energy Savannah River Site, Hatchery WMA on Lake Moultrie and Lake Cunningham WMA, a municipal reservoir owned by the City of Greer. Waterfowl harvest results from Category II Areas are provided in Table VII.

Waterfowl hunting opportunity on Category II Areas is measured by the number of available days. A total of 303 and 319 waterfowl hunting opportunity days were available on Category II Areas during the respective 2003-04 and 2004-05 waterfowl hunting seasons.

Habitat Management and Waterfowl Utilization on Tom Yawkey Wildlife Center

DNR staff conducts intensive habitat management on the diverse fresh, brackish and saline managed wetlands on Tom Yawkey Wildlife Center (TYWC),

another coastal area. Approximately 3,000 acres of wetlands in 20 management units on this site annually are managed for waterfowl and other wetland dependent species in accordance with stipulations of the benefactor, Tom Yawkey. Habitat on TYWC in 2003 was average as there was higher precipitation than desired for brackish habitat management. During the growing cycle of 2004 habitat conditions were unchanged from the previous year. Waterfowl utilization during 2003-04 was average for recent period, but waterfowl numbers were higher during 2004-05. Pursuant to Tom Yawkey's wishes TYWC is an inviolate sanctuary, and no waterfowl hunting is permitted.

Youth Waterfowl Hunts

Several DNR Category I Areas were available for youth participants during 1 day of the annually approved youth waterfowl hunting days. Tables VIII and IX provide harvest and youth waterfowl hunting opportunity data on areas available during these dates. A total of 61 youth harvested 141 ducks (2.31 ducks/hunter) on 7 areas in 2004. A total of 123 ducks were harvested by 58 youth (2.12 ducks/hunter) on 8 areas in 2005. During both years green-winged teal (24.8% and 19.5% respectively) were the leading birds in the collective bag.

BANDING AND BAND RETURN ANALYSIS

Banding waterfowl and analyzing band return data represent 2 of the most important tasks undertaken by waterfowl managers. Waterfowl banding data are vital to understand population parameters such as species and aggregate harvest and survival rates, species derivation and harvest distribution, and wintering habitat site fidelity. An emphasis was placed on waterfowl trapping and banding by field personnel during 2003-04 and 2004-05. DNR staff banded 2,709 and 1,115 waterfowl during the respective late winter periods of 2004 and 2005. Table X provides a summary of banding activities during both years.

It is premature to apply rigorous statistical analysis to recent post-season banding data related to SC, but pertinent information has been revealed despite lack of formal analysis. Traditionally it was believed SC wintering green-winged teal originated from eastern Canada. A large portion of the wintering green-winged teal population is derived from this region, but post-season banding indicates a segment also is affiliated with points farther west. Post-season banding also has revealed many blue-winged teal have winter fidelity to SC, arriving in September, rather than continuing to migrate farther south as previously believed.

Continuing pre-season and post-season banding will build on previous banding efforts in the state. Various studies have included SC post-season banding data as well as pre-season banding data from other states where ducks

were recovered in SC. Most work centers on mallards, the most numerous duck and the species with the most bandings in North America. Banding analysis has demonstrated wintering SC mallards are affiliated with Great Lakes and Prairie Pothole regions of North America. Pre-season band recoveries indicate nearly 75% of mallards wintering in SC are derived west of western Pennsylvania and southwestern Ontario, and very few mallards wintering in SC are derived from mid-Atlantic or Northeastern regions of the AF. Recent mallard satellite-telemetry data has reaffirmed these banding data.

Current harvest regulations in the Atlantic flyway under AHM are based on the Eastern Mallard Model. Research has demonstrated SC, and portions of North Carolina, more appropriately fit under the Mid-continent Mallard Model since the majority of the SC wintering waterfowl population is derived from regions encompassed by this model. As long as breeding habitat in both regions is exceptional the misplacement is probably not detrimental to SC. However, when conditions on the prairies are poor, which is more likely than in eastern Canada given the dynamic nature of prairie ecology, waterfowl wintering in SC will be subject to more liberal regulations than should be recommended for the population.

GOVERNOR'S WOOD DUCK PROJECT

The Statewide Wood Duck Nest Box Project was initiated in 1982 and funded with state duck stamp revenues through 2001-02. The project was renamed in 2004 becoming the *Governor's Wood Duck Project*. In 2004-05 the project received an infusion of private funding allowing construction and distribution of nest box units to requesting landowners after a hiatus of distributing new boxes during 2003 and 2004 due the need to direct SC duck stamp revenue to other waterfowl program areas. Ducks Unlimited, Inc. provided substantial funding to rejuvenate this project.

The project provides nest boxes, poles and predator guards to landowners having suitable wood duck production and brood-rearing habitat. Project cooperators voluntarily submit nest box data yielding minimum annual wood duck productivity estimates, in turn, providing valuable information on the status of wood ducks in SC as well as trends in wood duck production. The project supports hands-on private landowner waterfowl and wetland conservation and education opportunities for waterfowl enthusiasts and family members.

A total of 986 wood duck nest box units were distributed to 131 cooperators prior to the 2005 wood duck nesting period. Through this project, a total of 30,032 nest box units have been issued to 4,059 cooperators since 1982. Annual and cumulative distribution of wood duck nest box units are summarized respectively in Tables XI and XII.

Wood duck production data reported in 2004 from inspected nest boxes are summarized by county in Table XIII. Comparative reported annual production data, 1982-2004, are depicted in Table XIV. After the 2004 wood duck nesting season, 493 of 1,635 active cooperators (30.2%) provided data on 3,818 units (13.1% of allocated units). Figures 7 and 8 depict cooperator reporting and reporting rates 1982-2004. Due to there being no infusion of new cooperators into the project during 2003 and 2004 cooperator reporting decreased (-17.9%) from 2003. A total of 2,519 nest boxes (66.0% of the reported available) were reported utilized by wood ducks, representing an increase in reported utilization rate (+2.%) from 2003. A total of 2,140 nests were reported to be successful (85.0%) in 2004 producing a reported 16,989 wood ducklings from 25,771 eggs (Figure 9) representing an increase in successful nesting (+2.4) from 2003.

Since project data represent minimum estimates, actual wood duck production from the project exceeds these estimates. The fledgling rate of wood ducklings in 2004 was 65.9% of the reported eggs laid representing an increase (+1.7%) in fledgling from 2003. Wood duck production indices indicated increased wood duck production during 2003 and 2004 breaking a 4-year trend associated with prolonged drought from 1999 through 2002.

SATELLITE-TELEMETRY PROJECT

During 2003-04 and 2004-05 waterfowl project personnel cooperated with staff of New York Cooperative Fish and Wildlife Research Unit at Cornell University placing satellite-telemetry transmitters on SC wintering Northern pintails and mallards. Following successful project results during the pilot year (2002-03) in SC the project was expanded to 5 additional AF states in 2004-05. Cooperating state and Federal personnel coordinated trapping techniques, satellite transmitter attachment, project protocol and practiced attaching transmitters to captive-reared Northern pintails. A total of 41 transmitters (NC-15, SC-10, NJ-6, MD-4, VA-3, FL-3) were to be deployed in February 2004.

South Carolina Northern Pintails

DNR personnel targeted Northern pintails at trapping sites in cooperation with Federal personnel and private landowners. A total of 8 hen Northern pintails were captured at various SC wintering sites and fitted with satellite transmitters in February 2004. Seven of the 8 birds began spring migration. The exception was the lightest in weight of the 8 pintails marked, as it remained at its release site (SCR) until its signal was lost in mid-April. Migration of the remaining 7 Northern pintails was similar to the birds marked in 2003. The birds departed SC by late March as 5 marked birds were then in Ohio and Indiana, with the other 2 birds in New York east of Lake Ontario. By the end of April, 1 Northern pintail reached the upper border of North Dakota and Minnesota, and 2 other birds were in

eastern Minnesota. One bird remained on Lake Erie, and the other 2 Northern pintails staged along the St. Lawrence River in eastern Canada. Contact was lost with the remaining duck in Ohio in late March. As spring progressed, marked Northern pintails spread out across northern Canada before converging on Hudson Bay. The exception was a bird continuing northeast settling into Labrador before contact was lost in July. An additional bird was lost during May in eastern Minnesota.

In 2004 each transmitter included a UHF mortality sensor permitting researchers to locate immobile transmitters and allowing them to be refurbished and re-used. Cooperating state personnel found some transmitters previously attached to birds that died before migration. Personnel from Minnesota DNR located a transmitter from a SC instrumented bird, but the cause of mortality could not be determined.

Four Northern pintails were on the southwest coast of Hudson Bay in June, 2 via a route from James Bay, and the other 2 after departing prairie habitat and over-flying the Ontario boreal forest. In mid-summer 3 of the 4 Northern pintails remained along coastal Hudson Bay, spread from Ontario through Manitoba and as far north as Nunavut. The fourth bird departed Hudson Bay flying to North Dakota. One bird was lost in late July along coastal Hudson Bay in Ontario.

The remaining 3 Northern pintails were stationary until October when 1 departed Hudson Bay, and was shot at Saginaw Bay, Michigan in mid-October; the transmitter from this bird was returned to Cornell University with no report of anything unusual about the bird. Contact was lost with the second bird during the last week of October in Ontario south of James Bay. Coincidentally, contact was lost with 2 birds marked during the pilot project at the same time of year and region. The third Northern pintail moved to southern Minnesota by the first week of November where it was later harvested that week.

Transmitters weighing 20 grams have a 1-year battery allowing a surviving winter marked Northern pintail to be tracked through spring migration and the following fall migration back to the wintering grounds. One bird from 2003 survived to allow such tracking. This bird was marked in 2003 at SCR; it staged that spring on Lake Erie marshes of northern Ohio and spent most of summer in North Dakota, before moving to Hudson Bay in late summer where it remained until October. By November this bird moved to Lake Erie marshes before returning to SCR mid-December where it over-wintered. The transmitter battery expired when this duck was migrating through Ohio in spring 2004.

South Carolina Mallards

Evolving technology of satellite telemetry and project success with Northern pintails provided opportunity to track other species. Mallards were

chosen due to historical importance and recent decline of wintering populations of this species in SC. A total of 6 refurbished Canada goose transmitters weighing 30 grams were made available by Cornell University. Mallards are larger than Northern pintails enabling a heavier transmitter

DNR personnel captured 6 hen mallards at 3 sites in cooperation with Federal personnel and private landowners. Two birds each were captured, instrumented and released at Santee-Delta WMA, Santee National Wildlife Refuge and Two Rivers Farms. By mid-March all mallards were migrating north. One bird moved through North Carolina before ending up in southern Michigan by mid-April. Two birds migrated straight to the Lake Erie region. The other 3 birds staged in Maryland and Virginia before moving north into New York and Ontario.

Accurate interpretation of satellite data can be difficult. If no movement occurs over a period of time, the bird has either died and its transmitter is still in a position to transmit, it shed its transmitter, or it is still alive but making only small movements within the error range of the accurate satellite-telemetry. Five of the 6 mallards marked in 2004 showed no movement during summer 2004. Signals were sporadic by fall indicating weak batteries. The last known locations for 5 mallards were northern Minnesota, southern Michigan, western New York, northern New York, and southwestern Ontario. The remaining mallard moved into the Boreal Forest of northwestern Ontario by summer but was last located off of Georgian Bay near Sudbury, Ontario in mid-October 2004.

Summary and 2005 Field Season

DNR personnel successfully instrumented 8 hen Northern pintails and 6 hen mallards with satellite-telemetry transmitters during February 2004. The 2004 Northern pintail data was similar to results from birds marked in 2003. The ducks began leaving the state in March, some on a northwestern route through the Great Lakes and others on a more northerly path through eastern Ontario and western Quebec. With the exception of 1 pintail that went to Labrador, the remainder spent most or all of the spring and summer on the coast of Hudson Bay. Fall migration began in October, as the birds headed back through spring staging areas.

Mallard satellite-telemetry data provided further insight into mallard population with an affinity to winter in SC. All 6 ducks were affiliated with the Great Lakes region or points farther west in concert with band return interpretation. This has important management ramifications to formulation of annual waterfowl hunting regulations. Additional satellite-telemetry data along with increased banding of SC wintering mallards will increase the understanding of this species and its relationship to wintering in SC.

The third and final year of the project was scheduled for 2005, but mild late winter weather was not conducive to trapping resulting in the inability to capture any Northern pintails or mallards. Pledged funding will permit monitoring of 10 satellite transmitters, and plans are to instrument both hen pintails and mallards in February 2006 to complete the final year of the project.

SC DUCK STAMP PROGRAM

Since 1981-82 a SC duck stamp has been required to be purchased and in possession of all hunters while pursuing waterfowl. Enabling legislation requires SC duck stamp revenues to be spent on waterfowl projects in SC. Table XV provides information on duck stamp sales and revenue 1981-82 through 2004-05, and Figure 11 demonstrates trends in ducks stamp sales, e.g., the approximate number of waterfowl hunters in SC during the same period. Table XVI provides an analysis of approved SC Duck Stamp Budgets during 2003-04 and 2004-05.

WATERFOWL BENCHMARKS

Benchmarks or goals are necessary planning tools to ensure adequate effort and vision are being expended to address and work toward favorable resolution of issues including those affecting natural resources. Considerable data are available concerning waterfowl migrating to or through SC, and these data can be used to establish baselines and develop benchmarks indicating trends. The following benchmarks identify achievable goals reaching or exceeding tabulated high points, long-term averages or trends. Meeting these benchmarks will provide additional opportunity for over 25,000 SC waterfowl hunters to enjoy improved quality in recreational duck hunting and provide many benefits to SC citizens interested in waterfowl for purposes other than hunting.

These benchmarks were developed by DNR staff and accepted by the Waterfowl Advisory Committee. Status and achievements are indicated in italics following each stated benchmark.

Population Benchmarks

1. Increase mottled duck population in SC (as revealed by an annual fall survey, some baseline data available): *No annual fall surveys have been undertaken as of this time.*
2. Increase the number of wood ducks produced in SC (utilizing trends in certain nest box data): *Trends in wood duck production indicate this benchmark is being achieved as of this time.*

3. Increase the number of waterfowl wintering in SC as determined by improved long-term trends in the mid-winter survey: *Short-term trends have stabilized although there has not been a demonstrated upturn in the long-term trend.*
4. Maintain the current diversity of ducks migrating to and through and wintering in SC: *This benchmark is being achieved although there is concern over decreases in wintering mallards.*

Population Management Benchmarks

1. Increase the number of wood duck nest box units constructed/allocated each year through a reinvigorated/cooperative program: *This benchmark has been achieved through The Governor's Wood Duck Project whereby almost 1,000 wood duck nest box units were distributed to landowners in 2005.*

Harvest Benchmarks

1. Increase the number of ducks harvested/hunter/day in SC (FWS & DNR harvest data): *Waterfowl harvest per unit effort in SC decreased (-2.5%) from 2002-03 to 2003-04 according to FWS parts collection data.*
2. Increase the number of ducks harvested/hunter/day on DNR WMAs (with individual WMA and collective program goals): *Total harvest on WMAs increased 7.4% in 2004-05 from 2003-04, but harvest per unit effort on WMAs decreased 5.3%.*
3. Increase the number of mallards harvested/year in SC (FWS & DNR harvest data): *Mallard harvest in SC increased 16.4% from 2002-03 to 2003-04.*

Opportunity Benchmarks

1. Increase the number of waterfowl hunter days in SC (# of waterfowl hunters X average # of days afield/year): *Total waterfowl hunting days declined 6.6% from 2002-03 to 2003-04.*
2. Increase the number of waterfowl hunter days on existing DNR Category I WMAs (where practicable): *Total waterfowl hunting opportunity on DNR WMAs increased 13.4% from 2003-04 to 2004-05.*
3. Put existing/developing projects on line as Category I or II WMAs as soon as it can be recommended or is practicable (e.g., Wee Tee SF, Bonneau Ferry, Hickory Top): *This benchmark is being achieved; during 2004-05 an additional Category II Area was added to the list of 21 Category I Areas available in 2003-04.*

Human Dimension Benchmarks

1. Increase waterfowl hunter satisfaction (baseline data exists in previous survey efforts/future surveys will be conducted): *DNR staff plans for future surveys to add to baseline data.*

2. Increase communication between waterfowl enthusiasts & DNR (e.g., through the efforts of the Waterfowl Advisory Committee and by widely distributing a stand alone SC Annual Waterfowl Status Report): *This benchmark is being achieved through various products including an updated waterfowl information area on the DNR website.*

Habitat Benchmarks

1. Increase habitat indices on DNR WMAs (must first establish baselines perhaps through peer review): *Peer review efforts have been completed on 4 areas and others are planned.*
2. Increase acreage in inviolate sanctuary status in all major wintering areas as necessary (e.g., Pee Dee/Waccamaw/Black, Winyah Bay, Santee River Delta, ACE Basin, Santee Cooper Lakes): *This benchmark has not been addressed at this time.*
3. Acquire/develop additional high quality waterfowl habitat: *This benchmark will be addressed as funding permits.*
4. Enhance habitat on existing DNR Category I & II WMAs*: This benchmark is being achieved with significant habitat improvements completed on several WMAs as well as TYWC.*
5. Decrease coverage of common reed (*Phragmites communis*) on coastal WMAs: *This benchmark is being achieved; significant progress has been made eradicating common reed on TYWC, SCR and Santee-Delta WMAs.*

Funding Benchmarks: *All funding benchmarks are subject to legislative authority, and DNR staff is working on increased funding opportunities.*

1. Increase funding on DNR WMAs (through all sources including NAWCA Small Grant Projects)
2. Increase cost of SC Duck Stamp (enabling additional goal oriented waterfowl management)
3. Increase funding on NWRs (working with Congress & FWS)

Research Benchmarks

1. Determine additional characteristics of SC wintering Northern pintail and mallard originations, movement and site fidelity by satellite tracking: *This benchmark is being achieved.*
2. Further determine migration dynamics of mallards by continued examination of banding data: *This benchmark is being achieved.*
3. Increase number of ducks banded in SC particularly wood ducks and mallards: *DNR staff is continuing emphasis on waterfowl banding as a priority.*
4. Examine changes in harvest composition of top 5 species in the bag to determine long-term trends identifying if there are shifts of a magnitude to

prompt additional investigation: *Work on this benchmark has not been undertaken at this time.*

APPENDIX

WATERFOWL PROJECT REPORT

TABLES AND FIGURES

Table I. South Carolina mid-winter waterfowl survey estimated numbers of ducks, 2004 and 2005, compared with respective previous 5-year averages.

SPECIES	1999	2000	2001	2002	2003	1999-03 Average	2004	2003-04 Change	5-Year Change	2000-04 Average	2005	2004-05 Change	5-Year Change
Mallard	4,539	3,978	4,019	1,990	2,714	3,448	2,315	-14.7%	-32.9%	3,003	2,303	-0.5%	-23.3%
Black duck	724	1,070	807	961	953	903	642	-32.6%	-28.9%	887	804	25.2%	-9.3%
Gadwall	3,775	3,950	7,588	7,667	4,763	5,549	6,236	30.9%	12.4%	6,041	4,950	-20.6%	-18.1%
American wigeon	8,729	6,513	8,803	7,328	7,653	7,805	8,232	7.6%	5.5%	7,706	4,345	-47.2%	-43.6%
Green-winged teal	13,627	6,275	10,421	12,395	12,668	11,077	24,130	90.5%	117.8%	13,178	20,083	-16.8%	52.4%
Blue-winged teal	1,053	813	2,224	1,741	1,038	1,374	2,071	99.5%	50.7%	1,577	3,362	62.3%	113.1%
Northern shoveler	1,272	2,008	3,584	4,435	1,907	2,641	2,834	48.6%	7.3%	2,954	2,891	2.0%	-2.1%
Northern pintail	5,738	3,583	3,149	4,037	8,140	4,929	8,458	3.9%	71.6%	5,473	7,573	-10.5%	38.4%
Wood duck	5,642	784	2,304	1,267	956	2,191	10,012	947.3%	357.0%	3,065	2,565	-74.4%	-16.3%
TOTAL DABBLERS	**45,099**	**28,974**	**42,899**	**41,821**	**40,792**	**39,917**	**64,930**	**59.2%**	**62.7%**	**43,883**	**48,876**	**-24.7%**	**11.4%**
Redhead	12	0	27	23	0	12	36		190.3%	17	7	-80.6%	-59.3%
Canvasback	52	206	1,166	20	205	330	425	107.3%	28.9%	404	914	115.1%	126.0%
Scaup	1,111	4,780	11,948	2,307	9,011	5,831	5,708	-36.7%	-2.1%	6,751	1,520	-73.4%	-77.5%
Ring-necked duck	9,091	10,892	41,535	11,697	16,760	17,995	23700	41.4%	31.7%	20,917	19,296	-18.6%	-7.7%
Ruddy Duck	1,026	688	1,142	126	322	661	278	-13.7%	-57.9%	511	610	119.4%	19.3%
Bufflehead	446	287	521	358	345	391	334	-3.2%	-14.7%	369	583	74.6%	58.0%
TOTAL DIVERS	**11,738**	**16,853**	**56,339**	**14,531**	**26,643**	**25,221**	**30,481**	**14.4%**	**20.9%**	**28,969**	**22,930**	**-24.8%**	**-20.8%**
Sea ducks	36	0	6,635	0	0	1,334	1,247		-6.5%	1,576	1,440	15.5%	-8.7%
Mergansers	1,328	246	1,543	464	1,210	958	411	-66.0%	-57.1%	775	905	120.2%	16.8%
Unidentified	397	309	2,821	203	158	778	241	52.5%	-69.0%	746	270	12.0%	-63.8%
TOTAL DUCKS	**58,598**	**46,382**	**110,237**	**57,019**	**68,803**	**68,208**	**97,310**	**41.4%**	**42.7%**	**75,950**	**74,421**	**-23.5%**	**-2.0%**
Snow goose	407	411	433	670	506	485	634	25.3%	30.6%	531	648	2.2%	22.1%
Canada goose	1,195	1,241	1,201	1,499	2,012	1,430	1,524	-24.3%	6.6%	1,495	1,468	-3.7%	-1.8%
TOTAL GEESE	**1,602**	**1,652**	**1,634**	**2,169**	**2,518**	**1,915**	**2,158**	**-14.3%**	**12.7%**	**2,026**	**2,116**	**-1.9%**	**4.4%**
Tundra Swan	179	100	199	222	339	208	292	-13.9%	40.5%	230	125	-57.2%	-45.7%
American coot	27,572	21,596	25,666	15,427	5,775	19,207	8,294	43.6%	-56.8%	15,352	12,557	51.4%	-18.2%
TOTAL WATERFOWL	**87,951**	**69,730**	**137,736**	**74,837**	**77,435**	**89,538**	**108,054**	**39.5%**	**20.7%**	**93,558**	**89,219**	**-17.4%**	**-4.6%**

Table II. Atlantic Flyway mid-winter waterfowl survey estimated numbers of ducks, 2004 and 2005, compared with respective previous 10-year averages.

SPECIES	2003	1994-03 Average	2004	2003-04 Change	10-Year Change	1995-04 Average	2005	2004-05 Change	10-Year Change
Mallard	133,237	162,014	140,386	5.4%	-13.3%	162,729	131,802	-6.1%	-19.0%
Black duck	224,574	225,909	206,428	-8.1%	-8.6%	224,094	184,055	-10.8%	-17.9%
Mexican duck	0	2	0	N/A	-100.0%	2	0		-100.0%
Mottled duck	737	1,272	1,216	65.0%	-4.4%	1,320	15	-98.8%	-98.9%
Gadwall	23,409	22,091	25,040	7.0%	13.3%	22,254	16,909	-32.5%	-24.0%
American wigeon	34,833	44,649	48,345	38.8%	8.3%	46,000	17,800	-63.2%	-61.3%
Green-winged teal	57,202	75,858	77,770	36.0%	2.5%	77,915	63,501	-18.3%	-18.5%
Blue-winged teal	15,446	18,424	23,105	49.6%	25.4%	19,190	3,702	-84.0%	-80.7%
Northern shoveler	7,628	9,549	8,845	16.0%	-7.4%	9,671	4,599	-48.0%	-52.4%
Northern pintail	36,324	47,084	55,523	52.9%	17.9%	49,004	36,143	-34.9%	-26.2%
Wood duck	1,541	2,665	11,101	620.4%	316.5%	3,621	2,927	-73.6%	-19.2%
Whistling duck	55	800	672	1121.8%	-16.0%	862	0	-100.0%	-100.0%
TOTAL DABBLERS	**534,986**	**610,316**	**598,431**	**11.9%**	**-1.9%**	**616,661**	**461,453**	**-22.9%**	**-25.2%**
Redhead	12,365	104,594	105,455	752.9%	0.8%	113,903	45,630	-56.7%	-59.9%
Canvasback	70,650	89,031	50,342	-28.7%	-43.5%	87,000	58,980	17.2%	-32.2%
Scaup	336,916	524,697	399,163	18.5%	-23.9%	530,922	338,871	-15.1%	-36.2%
Ring-necked duck	63,673	91,264	86,214	35.4%	-5.5%	93,518	41,790	-51.5%	-55.3%
Goldeneye	21,268	26,017	18,990	-10.7%	-27.0%	25,789	21,441	12.9%	-16.9%
Bufflehead	74,009	68,281	53,394	-27.9%	-21.8%	66,220	71,007	33.0%	7.2%
Ruddy duck	79,871	85,360	94,885	18.8%	11.2%	86,861	57,038	-39.9%	-34.3%
TOTAL DIVERS	**658,752**	**989,242**	**808,443**	**22.7%**	**-18.3%**	**1,004,211**	**634,757**	**-21.5%**	**-36.8%**
Seaducks	98,343	155,413	93,945	-4.5%	-39.6%	154,973	175,344	86.6%	13.1%
Mergansers	67,523	86,354	58,293	-13.7%	-32.5%	85,431	54,799	-6.0%	-35.9%
Unidentified	328	2,839	699	113.1%	-75.4%	2,876	364	-47.9%	-87.3%
TOTAL DUCKS	**1,359,932**	**1,844,164**	**1,559,811**	**14.7%**	**-15.4%**	**1,864,152**	**1,326,717**	**-14.9%**	**-28.8%**
Brant	164,526	149,088	129,590	-21.2%	-13.1%	145,594	122,998	-5.1%	-15.5%
Snow goose	402,342	337,749	552,085	37.2%	63.5%	352,723	338,666	-38.7%	-4.0%
Canada goose	1,078,144	854,094	912,957	-15.3%	6.9%	837,575	873,270	-4.3%	4.3%
White front goose	0	2	3		50.0%	2	0	-100.0%	-100.0%
TOTAL GEESE	**1,645,012**	**1,340,932**	**1,594,635**	**-3.1%**	**18.9%**	**1,335,894**	**1,334,934**	**-16.3%**	**-0.1%**
Tundra swan	108,187	94,985	94,975	-12.2%	0.0%	93,664	68,735	-27.6%	-26.6%
Trumpeter swan	0	4	0		-100.0%	4	0	#DIV/0!	-100.0%
Mute swan	12,289	8,398	8,024	-34.7%	-4.5%	7,972	9,297	15.9%	16.6%
Unidentified swan	151	545	100	-33.8%	-81.7%	540	2	-98.0%	-99.6%
American coot	290,210	428,497	287,604	-0.9%	-32.9%	428,236	145,951	-49.3%	-65.9%
TOTAL WATERFOWL	**3,415,781**	**3,716,943**	**3,545,149**	**3.8%**	**-4.6%**	**3,729,880**	**2,885,636**	**-18.6%**	**-22.6%**

Table III. Waterfowl harvest on DNR Category I WMAs, 2003-04.

AREA	BEAVERDAM CREEK	BROAD RIVER	SANDY BEACH	SANTEE COASTAL RESERVE	SANTEE-DELTA	BEAR ISLAND	SPRINGFIELD/THE CUT	TOTAL ALL CATEGORY I AEAS	% COMPOSITION OF TOTAL HARVEST
SPECIES									
Mallard	13	38	34	12	118	21	7	243	10.47
Black duck		3	4	7	3	8	1	26	1.12
Mallard X Black				1		1		2	0.09
Mottled duck				44	2	40	17	103	4.44
Gadwall	1	7	6	124	2	3	7	150	6.47
American wigeon		12	4	120	2	8	1	147	6.34
Green-winged teal	6	14	31	184	154	18	30	437	18.84
Blue-winged teal	2		2	229	84	79	20	416	17.93
Northern shoveler		1		89	18	39	26	173	7.46
Northern pintail		1	4	23		6	1	35	1.51
Wood duck	9	27	42	2	84	3	3	170	7.33
Redhead		1						1	0.04
Canvasback								0	0.00
Scaup				49		3	1	53	2.28
Ring-necked duck	66	27	8	100	2		7	210	9.05
Goldeneye								0	0.00
Bufflehead				7		19		26	1.12
Ruddy duck						1		1	0.04
Canada goose								0	0.00
Snow goose				1				1	0.04
Mergansers	2	1	5	16		76	26	126	5.43
TOTAL HARVEST	99	132	140	1008	469	325	147	2320	
# HUNTERS	40	45	51	212	141	198	68	755	
DUCKS/HUNTER	2.48	2.93	2.75	4.75	3.33	1.64	2.16	3.07	
SHOTS FIRED	481	616	640	4288	1904	1934	690	10553	
CRIPPLES LOST	0	26	17	176	77	74	23	393	
% LOSS	0.00	16.46	10.83	14.86	14.10	18.55	13.53	14.49	

Table IV. Waterfowl harvest on DNR Category I WMAs, 2004-05.

AREA	BEAVERDAM CREEK	BROAD RIVER	SAMWORTH	SANDY BEACH	SANTEE COASTAL RESERVE	SANTEE-DELTA	BEAR ISLAND	SPRINGFIELD/THE CUT	TOTAL ALL CATEGORY I AREAS	% COMPOSITION OF TOTAL HARVEST
SPECIES										
Mallard	7	9	5	42	7	67	2	9	148	0.71
Dom/Rel Mallard				5	3	2	4	2	16	2.00
Black duck		4		2	8	2	4		20	0.88
Mallard X Black		1			5	1	1		8	0.35
Mottled duck					28	0	42	17	87	3.84
Gadwall	3	4		5	185	1	9	32	239	10.55
American wigeon		3		2	57	3	15	9	89	3.93
Green-winged teal	2	10	42	24	160	134	55	64	491	21.67
Blue-winged teal					194	65	76	37	372	16.42
Northern shoveler				2	143	42	14	21	222	9.80
Northern pintail				2	52	21	2	23	100	4.41
Wood duck	22	10	24	33	1	32	1	18	141	6.22
Redhead					2	0	0	1	3	0.13
Canvasback					0	0	0	1	1	0.04
Scaup				1	33	0	3		37	1.63
Ring-necked duck		12		4	66	4	2	12	100	4.41
Goldeneye					0	0	0		0	0.00
Bufflehead					14	0	17	1	32	1.41
Ruddy duck					15	0	0	1	16	0.71
Canada goose		2			0	0	0		2	0.09
Snow goose					0	0	0		0	0.00
Mergansers	4		2		21	19	69	27	142	6.27
TOTAL HARVEST	38	55	73	122	994	393	316	275	2266	
# HUNTERS	34	24	24	41	257	173	171	78	802	
DUCKS/HUNTER	1.12	2.29	3.04	2.98	3.87	2.27	1.85	3.53	2.83	
SHOTS FIRED	210	340	357	525	4663	1979	1739	1455	11268	
CRIPPLES LOST	5	11	9	11	213	80	89	52	470	
% LOSS	11.63	16.67	10.98	8.27	17.65	16.91	21.98	15.90	17.18	

Table V. Summary of minimum estimated waterfowl hunting opportunity in public waters adjacent to Samworth WMA, 1983-84 through 2003-04.

Year	Minimum # Hunters	Avaiable # Days	Minimum Average # Guns/Day
1983-84	1,288	41	31.4
1943-85	1,099	41	26.8
1985-86	1,005	43	23.4
1986-87	876	37	23.7
1987-88	833	36	23.1
1988-89	1,161	28	41.5
1989-90	1,332	28	47.6
1990-91	1,115	28	39.8
1991-92	1,312	28	46.9
1992-93	1,399	26	53.8
1993-94	1,729	27	64.0
1994-95	1,430	36	39.7
1995-96	1,098	45	24.4
1996-97	1,097	44	24.9
1997-98	1,259	49	25.7
1998-99	2,173	60	36.2
1999-00	1,410	60	23.5
2000-01	1,498	60	25.0
2001-02	1,260	60	21.0
2002-03	1,025	50	20.5
2003-04	1,664	50	33.3
21-year Average	**1,289**	**42**	**33.2**

Table VI. Waterfowl harvest on DNR Category I, II and Adult Youth Areas, 2003-04 and 2004-05.

TYPE AREA	CATEGORY I AREAS		CATEGORY II AREAS		ADULT YOUTH AREAS		ALL AREAS		% CHANGE FROM 2003-04 TO 2004-05	% OF AGGREGATE BAG
					CLEMSON	DONNELLEY				
YEAR	**03-04**	**04-05**	**03-04**	**04-05**	**04-05**		**03-04**	**04-05**		
SPECIES										
Mallard	243	148	11	31	1		254	180	-29.1	8.31
Dom/Rel Mallard		16				11	0	27	270.0	0.52
Black duck	26	20		4			26	24	-7.7	0.96
Mallard X Black	2	8		1			2	9	350.0	0.21
Mottled duck	103	87				1	103	88	-14.6	3.66
Gadwall	150	239	4			1	154	240	55.8	7.54
American wigeon	147	89		2			147	91	-38.1	4.56
Green-winged teal	437	491	1	9		39	438	539	23.1	18.71
Blue-winged teal	416	372				25	416	397	-4.6	15.57
Northern shoveler	173	222		1		1	173	224	29.5	7.60
Northern pintail	35	100		1			35	101	188.6	2.60
Wood duck	170	141	133	184	1	53	303	379	25.1	13.06
Redhead	1	3					1	3	200.0	0.08
Canvasback		1					0	1	100.0	0.02
Scaup	53	37	1				54	37	-31.5	1.74
Ring-necked duck	210	100		2		6	210	108	-48.6	6.09
Goldeneye							0	0	0.0	0.00
Bufflehead	26	32		13			26	45	73.1	1.36
Ruddy duck	1	16					1	16	1500.0	0.33
Canada goose		2		6			0	8	800.0	0.15
Snow goose	1						1	0	-100.0	0.02
Mergansers	126	142	3	7		17	129	166	28.7	5.65
Unknown duck			45	22			45	22	-51.1	1.28
TOTAL HARVEST	2320	2266	198	283	2	154	2518	2705	7.4	
# HUNTERS	755	802	366	404	12	53	1121	1271	13.4	
DUCKS/HUNTER	3.07	2.83	0.54	0.70	0.17	2.91	2.25	2.13	-5.3	
SHOTS FIRED	10553	11268	1705	2320	43	764	12258	14395	17.4	
CRIPPLES LOST	393	470	49	67	7	39	442	583	31.9	
% LOSS	14.49	17.18	19.84	19.14	77.78	20.21	14.93	17.73	18.7	

Table VII. Waterfowl harvest on DNR Category II WMAs, 2003-04 and 2004-05.

AREA	CRACKERNECK		HATCHERY		LAKE CUNNINGHAM		TOTAL CATEGORY II AEAS		% COMPOSITION OF TOTAL HARVEST	
YEAR	**03-04**	**04-05**	**03-04**	**04-05**	**03-04**	**04-05**	**03-04**	**04-05**	**03-04**	**04-05**
SPECIES										
Mallard					11	31	11	31	5.56	10.95
Black duck						4	0	4	0.00	1.41
Mallard X Black						1	0	1	0.00	0.35
Mottled duck							0	0	0.00	0.00
Gadwall					4		4	0	2.02	0.00
American wigeon						2	0	2	0.00	0.71
Green-winged teal		2			1	7	1	9	0.51	3.18
Blue-winged teal							0	0	0.00	0.00
Northern shoveler						1	0	1	0.00	0.35
Northern pintail						1	0	1	0.00	0.35
Wood duck	121	134			12	50	133	184	67.17	65.02
Redhead							0	0	0.00	0.00
Canvasback							0	0	0.00	0.00
Scaup	1						1	0	0.51	0.00
Ring-necked duck						2	0	2	0.00	0.71
Goldeneye							0	0	0.00	0.00
Bufflehead						13	0	13	0.00	4.59
Ruddy duck							0	0	0.00	0.00
Canada goose						6	0	6	0.00	2.12
Snow goose							0	0	0.00	0.00
Mergansers	2	3			1	4	3	7	1.52	2.47
Unknown duck			45	22			45	22	22.73	7.77
TOTAL HARVEST	124	139	45	22	29	122	198	283		
# HUNTERS	158	215	89	55	119	134	366	404		
DUCKS/HUNTER	0.78	0.65	0.51	0.40	0.24	0.91	0.54	0.70		
SHOTS FIRED	1109	1458	350	89	246	773	1705	2320		
CRIPPLES LOST	34	41	9	3	6	23	49	67		
% LOSS	21.52	22.78	16.67	12.00	17.14	15.86	19.84	19.14		

Table VIII. Youth hunt waterfowl harvest on DNR Category I WMAs, 2004.

YOUTH HUNT AREAS	BEAR ISLAND	BEAVERDAM CREEK	SAMWORTH	SANDY BEACH	SANTEE-DELTA	SANTEE COASTAL RESERVE	DONNELLEY	GRAND TOTAL
SPECIES								
Mallard	1		1	1	9		1	13
Dom/Rel Mallard								0
Black duck								0
Mallard x Black								0
Mottled duck	1					1		2
Gadwall	2					6		8
American wigeon	2					6	1	9
Green-winged teal	11	1	1	6	6	7	3	35
Blue-winged teal	2		1		14	7		24
Northern shoveler	9					1		10
Northern pintail	2				3	2		7
Wood duck			1		1		4	6
Redhead								0
Canvasback								0
Scaup								0
Ring-necked duck	1					2	5	8
Golden-eye								0
Bufflehead								0
Ruddy duck								0
Tree ducks								0
Sea ducks								0
Canada goose								0
Snow goose								0
Unknown ducks								0
Mergansers	4		5		6	2	2	19
TOTAL HARVEST	35	1	9	7	39	34	16	141
# HUNTERS	13	1	11	4	12	11	9	61
DUCKS/HUNTER	2.69	1.00	0.82	1.75	3.25	3.09	1.78	2.31
SHOTS FIRED	277	5	104	30	196	250	167	1029
CRIPPLES LOST	10	2	4	1	6	10	4	37
% LOSS	22.22	66.67	30.77	12.50	13.33	22.73	20.00	20.79

Table IX. Youth hunt waterfowl harvest on DNR Category I WMAs, 2005.

YOUTH HUNT AREAS	BEAR ISLAND	BEAVERDAM CREEK	SAMWORTH	SANDY BEACH	SANTEE-DELTA	SANTEE COASTAL RESERVE	CLEMSON	DONNELLEY	GRAND TOTAL
SPECIES									
Mallard		2	2		7				11
Dom/Rel Mallard								8	8
Black duck					1				1
Mallard x Black									0
Mottled duck	1								1
Gadwall	5								5
American wigeon	1								1
Green-winged teal	12		3		3	6			24
Blue-winged teal	4				2	7		4	17
Northern shoveler	7				10	3			20
Northern pintail	2				2	4		1	9
Wood duck	2		4				1	5	12
Redhead									0
Canvasback									0
Scaup						1			1
Ring-necked duck	1		1			2			4
Golden-eye									0
Bufflehead									0
Ruddy duck									0
Tree ducks									0
Sea ducks									0
Canada goose									0
Snow goose									0
Unknown ducks									0
Mergansers	1		1			3		4	9
TOTAL HARVEST	36	2	11	0	25	26	1	22	123
# HUNTERS	14	2	8	2	15	9	2	6	58
DUCKS/HUNTER	2.57	1.00	1.38	0.00	1.67	2.89	0.50	3.67	2.12
SHOTS FIRED	260	33	113	24	134	195	18	97	874
CRIPPLES LOST	7	2	9	1	9	8	1	3	40
% LOSS	16.28	50.00	45.00	100.00	26.47	23.53	50.00	12.00	24.54

Table X. Post season waterfowl banding effort by project, 2004 and 2005.

PROJECT	REGION 2	REGION 3		REGION 4		DONNELLEY WMA		SANTEE-DELTA WMA		SANTEE COASTAL RESERVE		YAWKEY WILDLIFE CENTER	TOTALS	
YEAR	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2005**	**2004**	**2005**
SPECIES														
Mallard		8	3	48				5	3				61	6
Black duck		1	2	4				1				5	6	7
Mottled duck													0	0
Gadwall		6											6	0
Wigeon		27	2	20									47	2
Green-winged teal		166	17	58		56	284	13	21	249	26	2	542	350
Blue-winged teal				4		2	1	238	29	431	53	4	675	87
Northern shoveler		9		2									11	0
Northern pintail				10		2			2	1			13	2
Wood duck	76	313	276	345	178	67	29	13	18				738	577
Lesser scaup		1								443			444	0
Ring-necked duck		9	65	137	17					19	2		165	84
Hooded merganser										1			1	0
TOTALS	76	540	365	628	195	127	314	270	73	1,144	81	11	2,709	1,115

Table XI. Distribution of wood duck boxes by site, 2005.

Distribution Site	Number of Units Distributed	Number of Cooperators	Number of New Cooperators
Clemson	39	8	8
Greenwood	49	6	5
Styx	137	22	17
Union	47	9	7
Dennis Center	50	6	3
Webb Center	25	3	2
Samworth	441	47	34
Florence	113	16	13
Donnelley	85	14	9
Total Distribution	**986**	**131**	**98**

Table XII. Summary of wood duck nest box unit distribution, 1982-2005.

Year	Annual Distribution		Cummulative Distribution	
	# Cooperators	# Units	# Cooperators	# Units
1982	232	1,775	232	1,775
1983	264	1,924	496	3,699
1984	191	1,777	687	5,476
1985	189	1,187	876	6,663
1986	119	910	995	7,573
1987	113	1,059	1,108	8,632
1988	158	1,221	1,266	9,853
1989	135	1,098	1,401	10,951
1990	204	1,811	1,605	12,762
1991	164	1,119	1,769	13,881
1992	218	1,509	1,987	15,390
1993	240	1,533	2,227	16,923
1994	203	1,488	2,430	18,411
1995	200	1,389	2,630	19,800
1996	194	1,339	2,824	21,139
1997	161	1,291	2,985	22,430
1998	179	1,335	3,164	23,765
1999	215	1,414	3,379	25,179
2000	208	1,313	3,587	26,492
2001	212	1,432	3,799	27,924
2002	129	1,122	3,928	29,046
2005	131	986	4,059	30,032

Table XIII. Wood duck production by county in SC, 2004.

COUNTY	# COOPS	# BOXES	# USED	% USED	# NESTS	% SUCCESS	# HATCHED	# LAID
Abbeville	4	17	12	70.6%	12	100.0%	137	158
Aiken	13	199	159	79.9%	147	92.5%	1,323	1,785
Allendale	6	76	47	61.8%	37	78.7%	123	153
Anderson	13	55	26	47.3%	25	96.2%	162	218
Bamberg	6	64	39	60.9%	30	76.9%	163	262
Barnwell	6	48	22	45.8%	16	72.7%	185	293
Beaufort	9	326	206	63.2%	161	78.2%	1,342	2,656
Berkeley	18	233	148	63.5%	117	79.1%	703	1,199
Calhoun	16	114	85	74.6%	71	83.5%	504	920
Charleston	14	69	36	52.2%	27	75.0%	159	211
Cherokee	2	17	25	147.1%	24	96.0%	135	57
Chester	2	10	4	40.0%	4	100.0%	36	42
Chesterfield	15	152	105	69.1%	91	86.7%	683	1,372
Clarendon	8	50	33	66.0%	28	84.8%	238	408
Colleton	17	104	54	51.9%	48	88.9%	400	501
Darlington	6	39	18	46.2%	16	88.9%	145	172
Dillon	0	0	0	0.0%	0	0.0%	0	0
Dorchester	11	118	89	75.4%	78	87.6%	689	793
Edgefield	18	78	52	66.7%	52	100.0%	530	575
Fairfield	7	46	38	82.6%	33	86.8%	132	238
Florence	17	125	77	61.6%	61	79.2%	541	862
Georgetown	10	186	64	34.4%	62	96.9%	343	485
Greenville	19	72	41	56.9%	34	82.9%	263	379
Greenwood	13	88	55	62.5%	50	90.9%	392	555
Hampton	7	39	27	69.2%	24	88.9%	140	174
Horry	9	71	52	73.2%	48	92.3%	389	495
Jasper	2	26	9	34.6%	9	100.0%	40	50
Kershaw	14	93	71	76.3%	66	93.0%	587	922
Lancaster	6	26	18	69.2%	15	83.3%	256	378
Laurens	5	36	27	75.0%	22	81.5%	154	195
Lee	4	63	45	71.4%	42	93.3%	484	568
Lexington	41	176	124	70.5%	109	87.9%	927	1,563
McCormick	4	7	2	28.6%	0	0.0%	0	0
Marion	5	57	40	70.2%	36	90.0%	295	324
Marlboro	1	19	6	31.6%	6	100.0%	72	72
Newberry	16	66	54	81.8%	47	87.0%	522	681
Oconee	8	26	9	34.6%	5	55.6%	46	84
Orangeburg	16	135	132	97.8%	90	68.2%	633	1,015
Pickens	6	20	9	45.0%	8	88.9%	78	109
Richland	27	154	106	68.8%	96	90.6%	572	1,007
Saluda	9	35	24	68.6%	23	95.8%	176	268
Spartanburg	22	98	78	79.6%	66	84.6%	519	786
Sumter	13	130	82	63.1%	70	85.4%	720	1,233
Union	4	28	26	92.9%	26	100.0%	145	217
Williamsburg	12	75	44	58.7%	39	88.6%	303	401
York	12	152	99	65.1%	69	69.7%	603	935
TOTAL	493	3,818	2,519	66.0%	2,140	85.0%	16,989	25,771

Table XIV. Project wood duck production in SC, 1982-2004.

YEAR	# COOPERATORS	# BOXES REPORTED	# BOXES USED	% BOXES USED	# NESTS	% NEST SUCCESS	# EGGS HATCHED	# EGGS LAID
1982	226	1,256	200	15.9%	169	84.5%	1,332	2,130
1983	441	2,726	754	27.7%	660	87.5%	6,404	9,474
1984	540	3,849	1,472	38.2%	1,224	83.2%	11,679	18,147
1985	617	4,131	1,653	40.0%	1,415	85.6%	14,788	21,425
1986	571	3,733	1,749	46.9%	1,523	87.1%	16,076	23,668
1987	551	3,756	2,238	59.6%	1,846	82.5%	21,400	33,737
1988	465	3,243	2,192	67.6%	1,898	86.6%	22,458	31,482
1989	450	2,828	1,917	67.8%	1,739	90.7%	19,095	26,554
1990	421	1,403	1,091	77.8%	942	86.3%	11,759	17,260
1991	621	3,413	1,921	56.3%	1,660	86.4%	18,987	25,633
1992	456	2,066	1,535	74.3%	1,329	86.6%	15,967	20,215
1993	497	2,075	1,485	71.6%	1,325	89.2%	16,831	23,489
1994	296	1,977	1,446	73.1%	1,226	84.8%	14,669	21,165
1995	1,057	6,868	4,432	64.5%	3,810	86.0%	38,363	58,126
1996	829	5,437	3,795	69.8%	3,214	84.7%	32,188	49,141
1997	1,035	7,026	4,747	67.6%	4,071	85.8%	39,647	58,625
1998	934	7,095	4,972	70.1%	4,241	85.3%	43,195	64,292
1999	947	6,765	4,772	70.5%	4,148	86.9%	36,427	55,537
2000	859	5,027	3,546	70.5%	3,072	86.6%	27,874	41,181
2001	894	5,485	3,752	68.4%	3,308	88.2%	25,965	39,117
2002	806	4,963	2,931	59.1%	2,437	83.1%	20,967	31,610
2003	601	4,543	2,934	64.6%	2,436	83.0%	18,600	28,691
2004	493	3,818	2,519	66.0%	2,140	85.0%	16,989	25,771
TOTAL	**14,607**	**93,483**	**58,053**	**62.1%**	**49,833**	**85.8%**	**491,660**	**726,470**

Table XV. Duck stamp sales and SC stamp revenue, 1981-82 through 2004-05.

	South Carolina			Federal
Year	**Stamps Sold***	**Revenue****	**Total Revenue**	**Stamps Sold*****
1981-82	20,811	$104,055	$187,716	19,525
1982-83	21,437	$107,185	$153,088	20,348
1983-84	20,945	$104,725	$149,671	20,101
1984-85	21,082	$105,410	$144,669	20,762
1985-86	18,979	$94,895	$140,265	18,650
1986-87	19,780	$98,900	$163,948	19,598
1987-88	20,558	$102,790	$192,660	19,303
1988-89	17,593	$87,965	$213,469	16,148
1989-90	16,524	$82,620	$165,219	15,482
1990-91	17,049	$85,245	$269,635	15,832
1991-92	16,795	$83,975	$161,751	15,139
1992-93	16,962	$84,810	$150,705	16,182
1993-94	16,986	$84,930	$143,488	20,185
1994-95	18,589	$92,945	$146,433	17,659
1995-96	21,312	$106,560	$156,654	19,715
1996-97	22,448	$112,240	$155,074	22,192
1997-98	22,666	$113,330	$150,120	25,643
1998-99	23,206	$116,030	$152,143	23,904
1999-00	23,707	$118,535	$146,308	24,351
2000-01	25,441	$127,205	$156,432	25,056
2001-02	24,781	$123,905	$145,569	23,370
2002-03	26,047	$130,235	$154,182	23,326
2003-04	28,266	$141,330	$158,583	unavailable
2004-05	27,769	$138,845	unavailable	unavailable
Averages	21,239	$106,194	163,382	20,112
Totals	509,733	$2,548,665	$3,757,782	442,471
* 2004-05 state stamps subject to correction				
** Revenue from hunters only				
*** Total stamps sold in SC				

Table XVI. SC duck stamp budget allocations, 2003-04 and 2004-05.

Category	2003-04 Budgeted Amount	Budget Description	2004-05 Budgeted Amount	Budget Description
Advertising & Promotion	$2,000	Promotion of sale of duck stamps	$1,000	Promotion of sale of duck stamps
Waterfowl Restoration & Research	$10,000	Northern pintail/mallard satellite-telemetry project	$22,500	$10K satellite-telemetry; $10K for banding; $2.25K administrate WD Project
Vegetation Control	$30,000	Chemical control of undesirable vegetation on WMAs	$60,000	Chemical control of undesirable vegetation on WMAs
Mountains & Piedmont			$9,000	Habitat improvements on Category I and II WMAs in the Piedmont
Donnelley			$5,000	Operation and maintenance of Donnelley WMA
Hickory Top	$50,000	Further development of Hickory Top WMA in Clarendon County	$50,000	Further development of Hickory Top WMA in Clarendon County
Santee-Delta			$9,750	Gyro-track cutting of willow trees to create 10 one-acre openings
Santee Coastal Reserve	$58,000	Operation and maintenance of Santee Coastal Reserve	$22,750	Operation and maintenance of Santee Coastal Reserve
Total Budget	$150,000		$180,000	

Figure 1. South Carolina mid-winter waterfowl survey estimated numbers of ducks, 1964-2005.

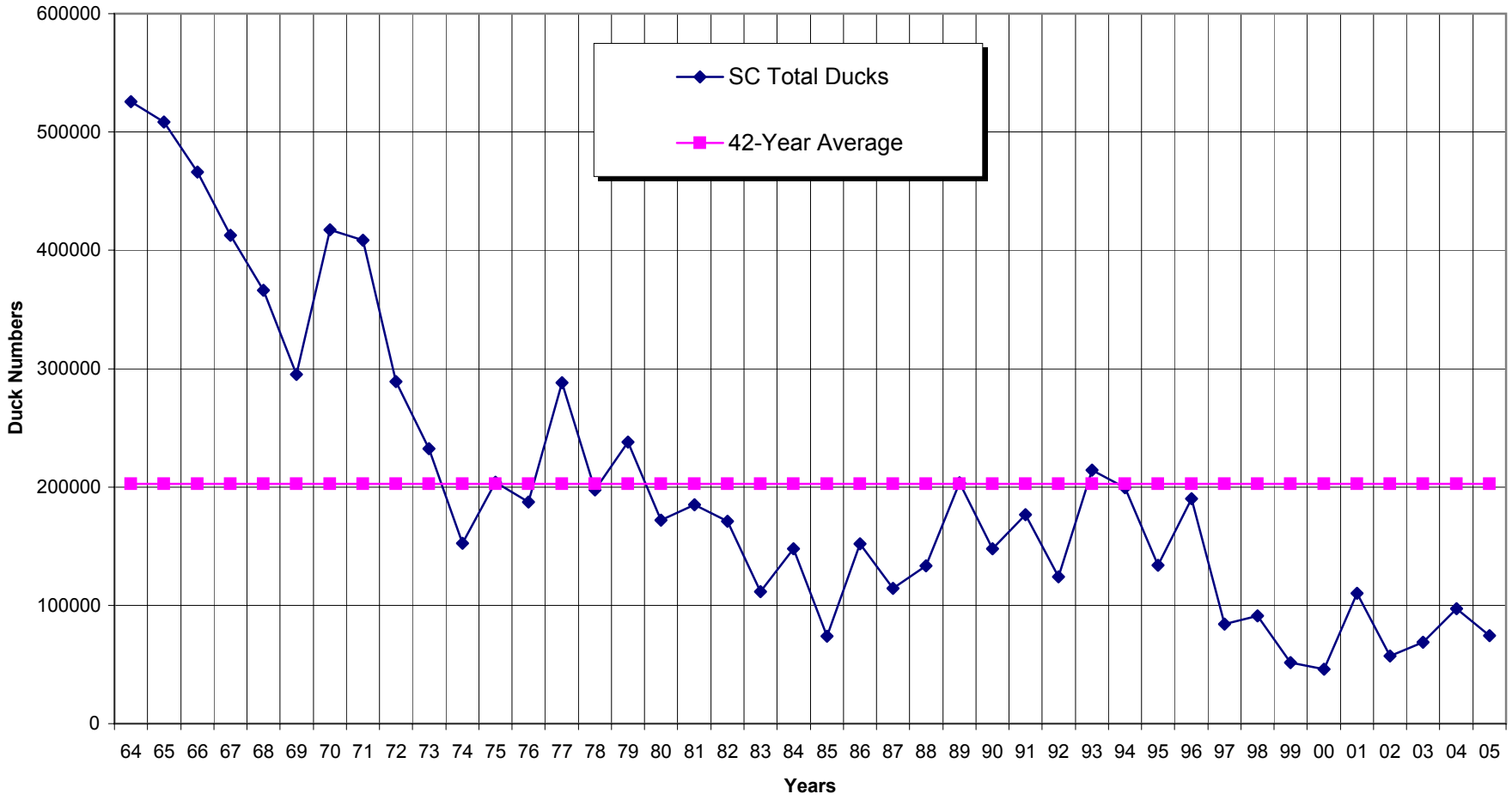


Figure 2. South Carolina mid-winter waterfowl survey estimated numbers of geese, 1964-2005.

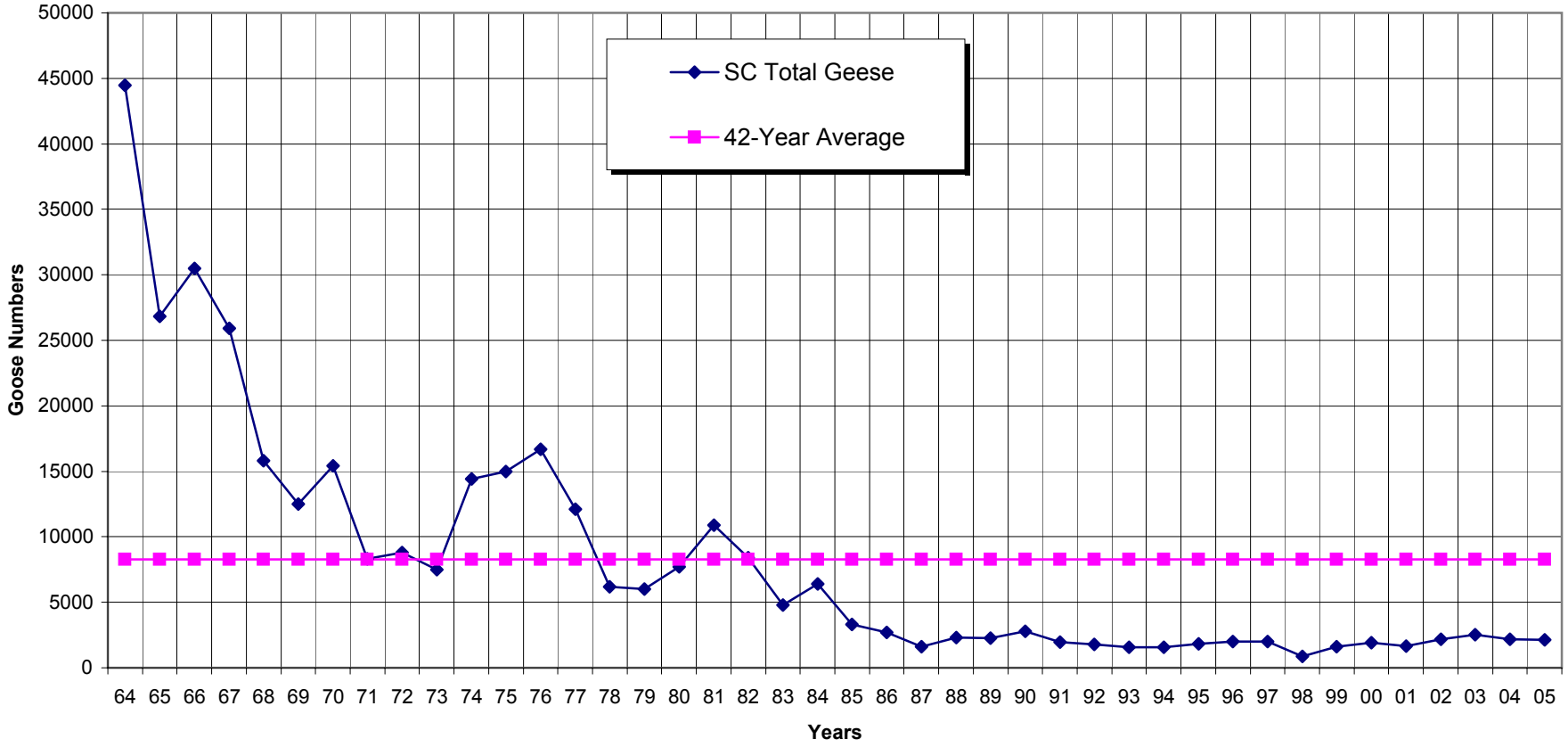


Figure 3. Atlantic Flyway mid-winter waterfowl survey estimated numbers of ducks, 1964-2005.

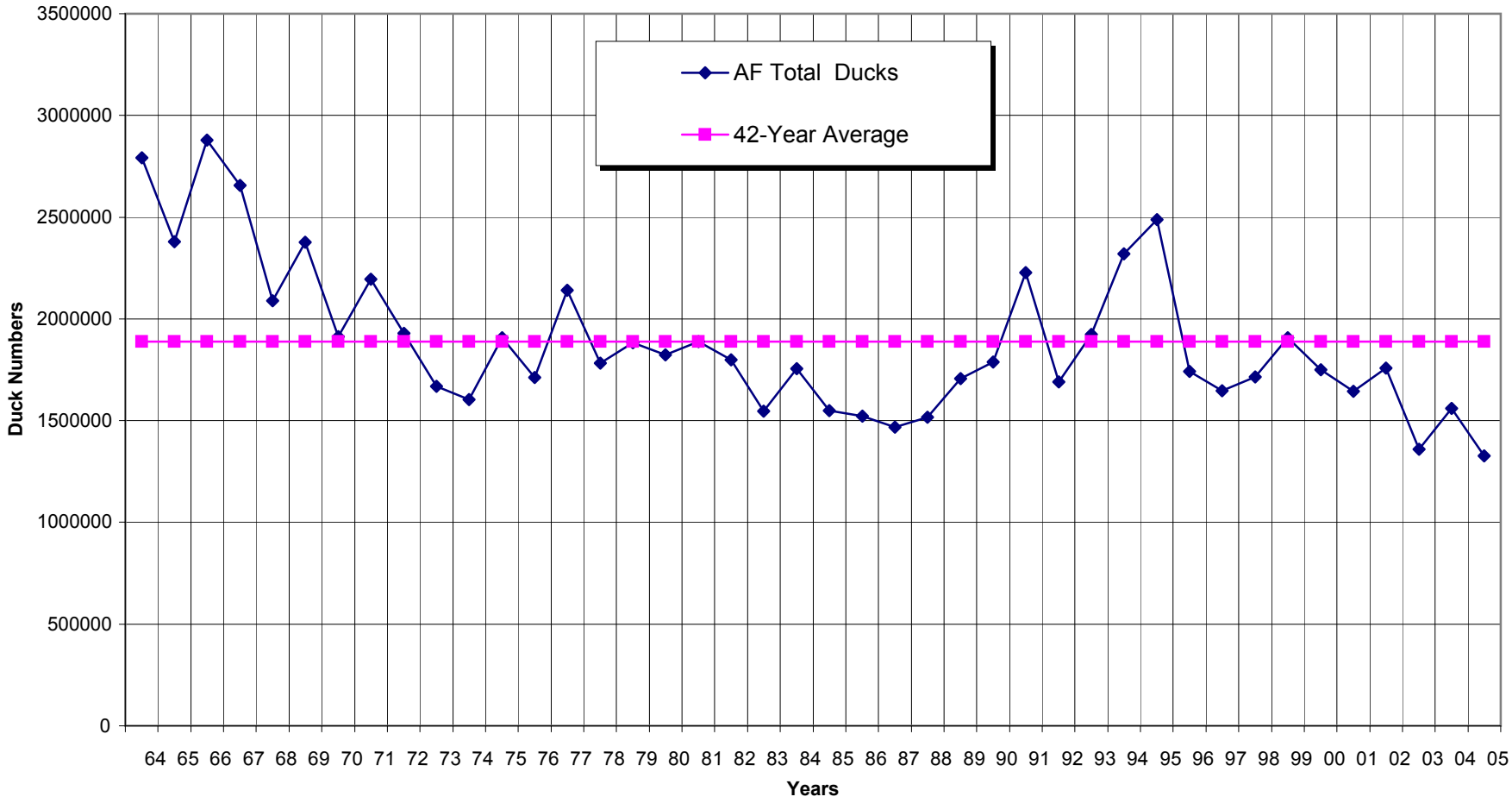


Figure 4. Atlantic Flyway mid-winter waterfowl survey estimated numbers of Canada geese, brant and snow geese, 1964-2005.

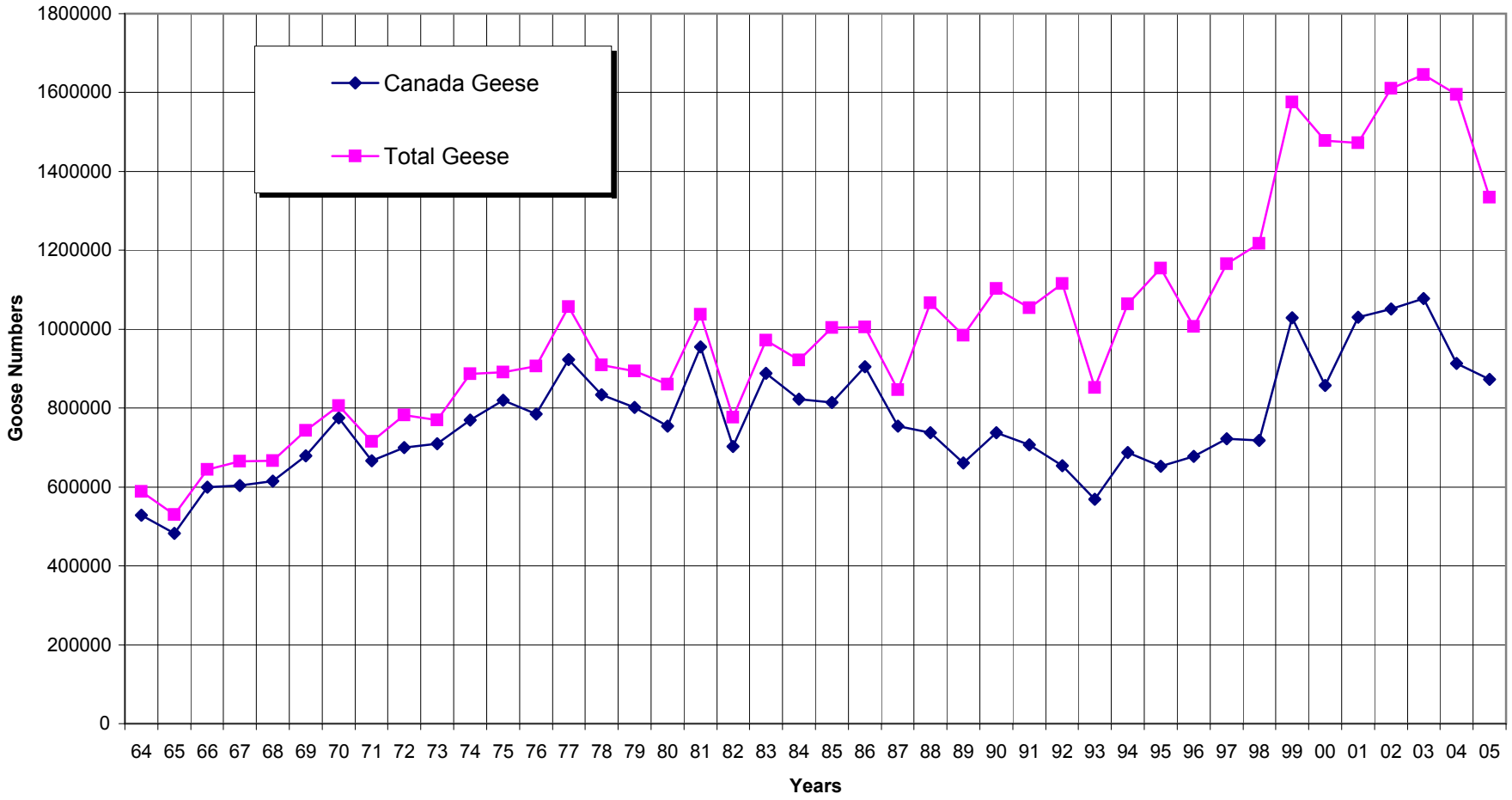


Figure 5. Estimated number of waterfowlers annually hunting in public water adjacent to Samworth WMA, 1983-84 through 2003-04.

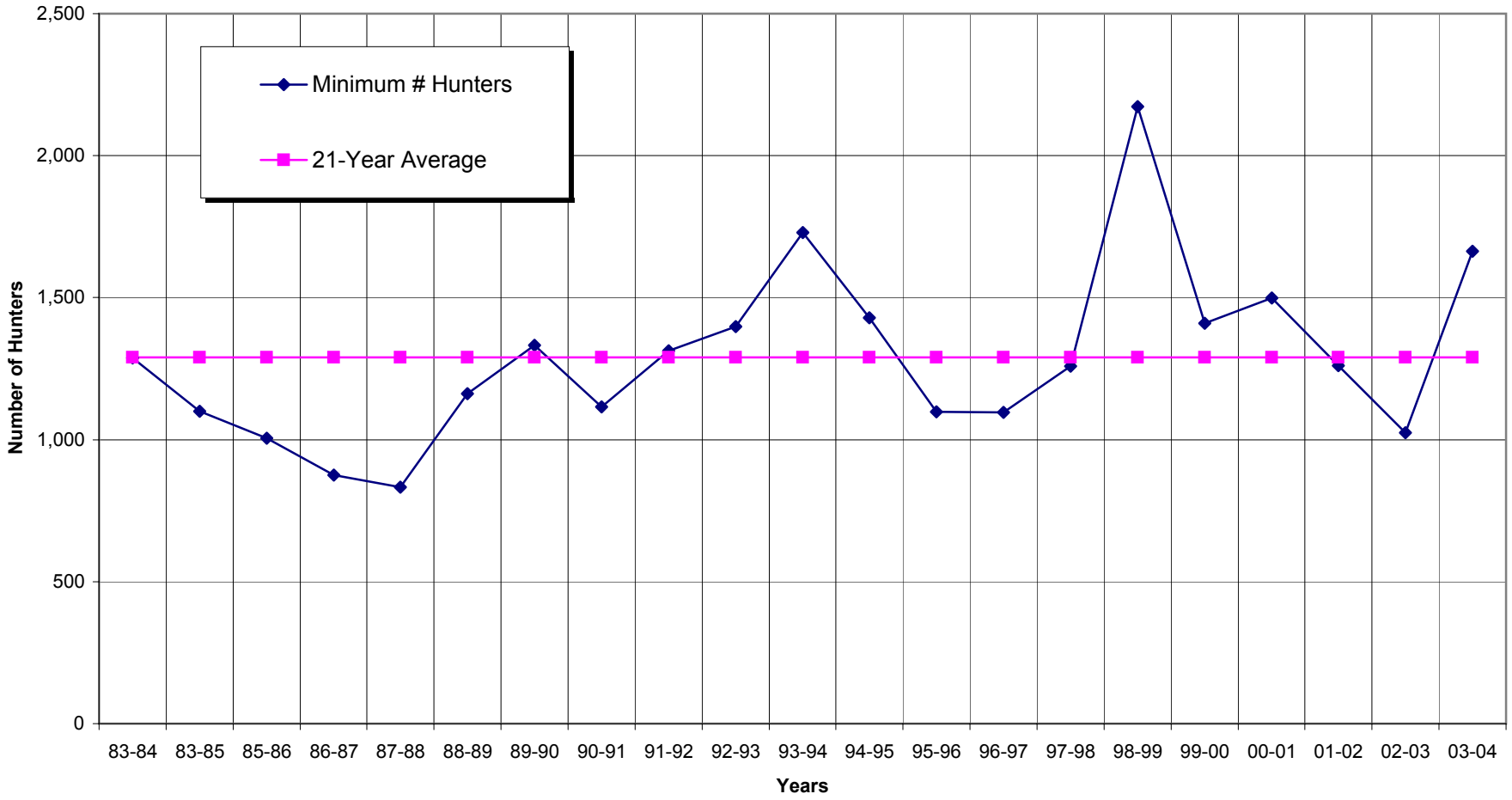


Figure. 6. Annual waterfowl harvest/hunter/day on DNR Category I and II Areas, 1969-70 through 2004-05.

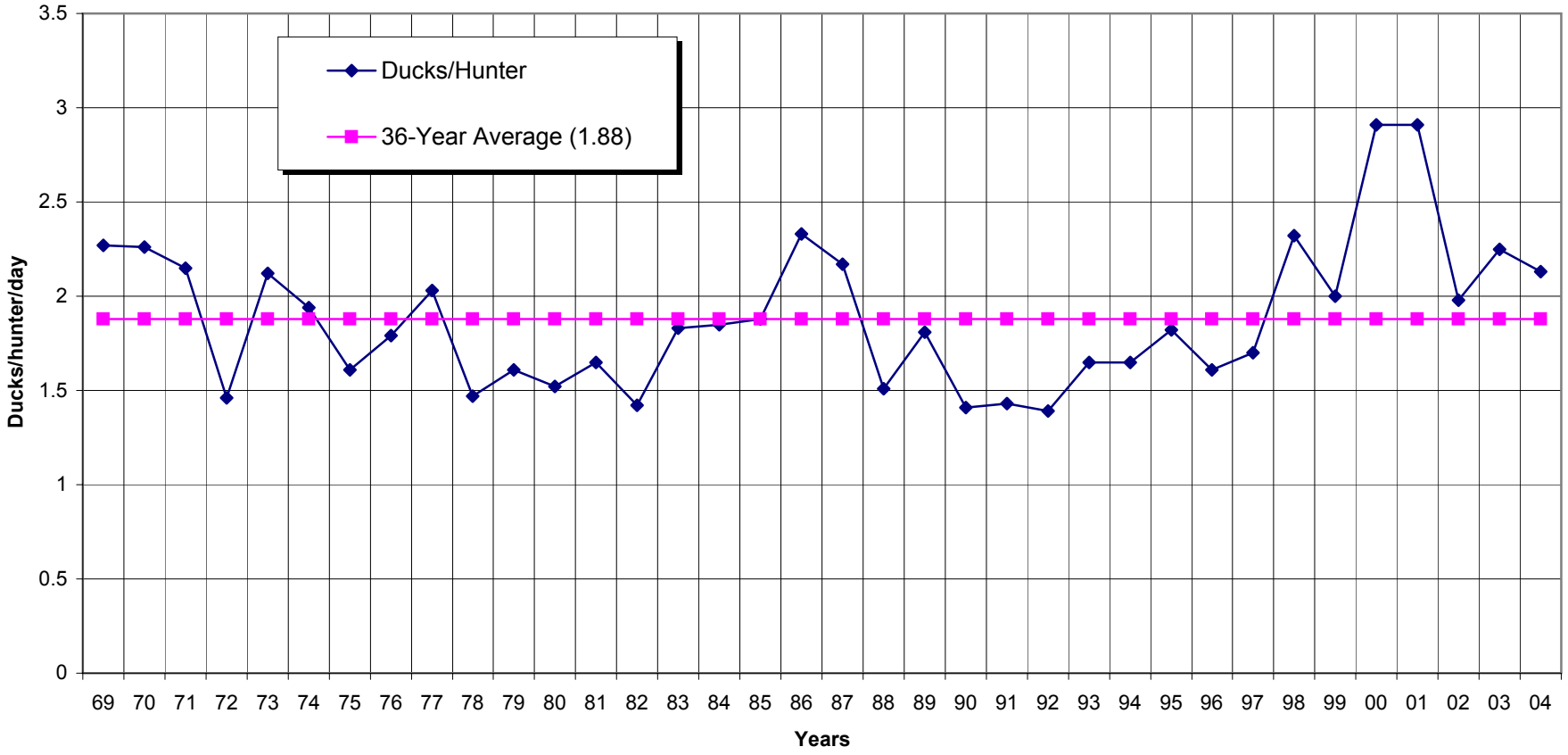


Figure 7. Governor's wood duck project cooperator reporting, 1982-2004.

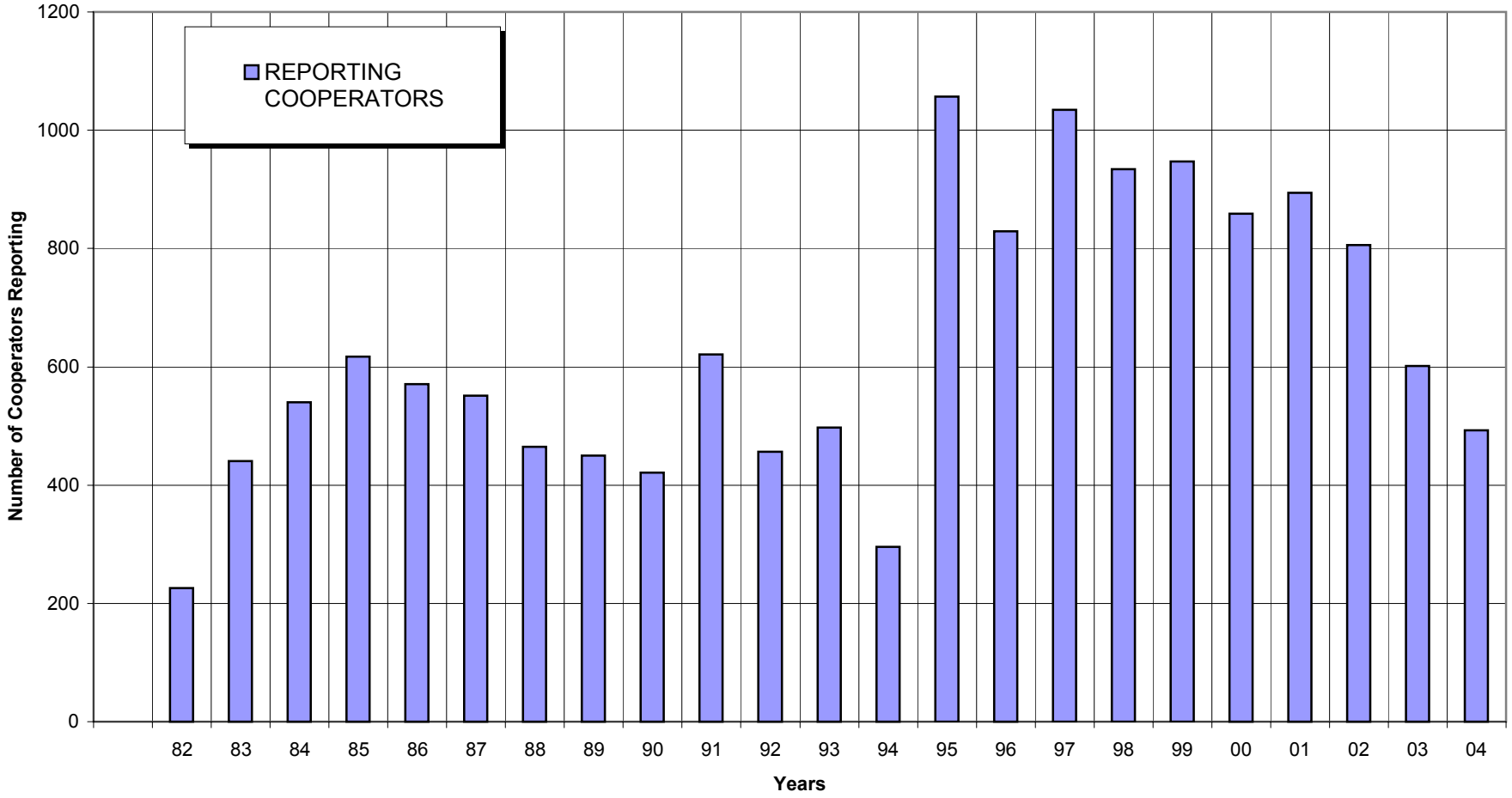


Figure 8. Governor's wood duck project percentage of cooperators reporting nesting activity, 1982-2004.

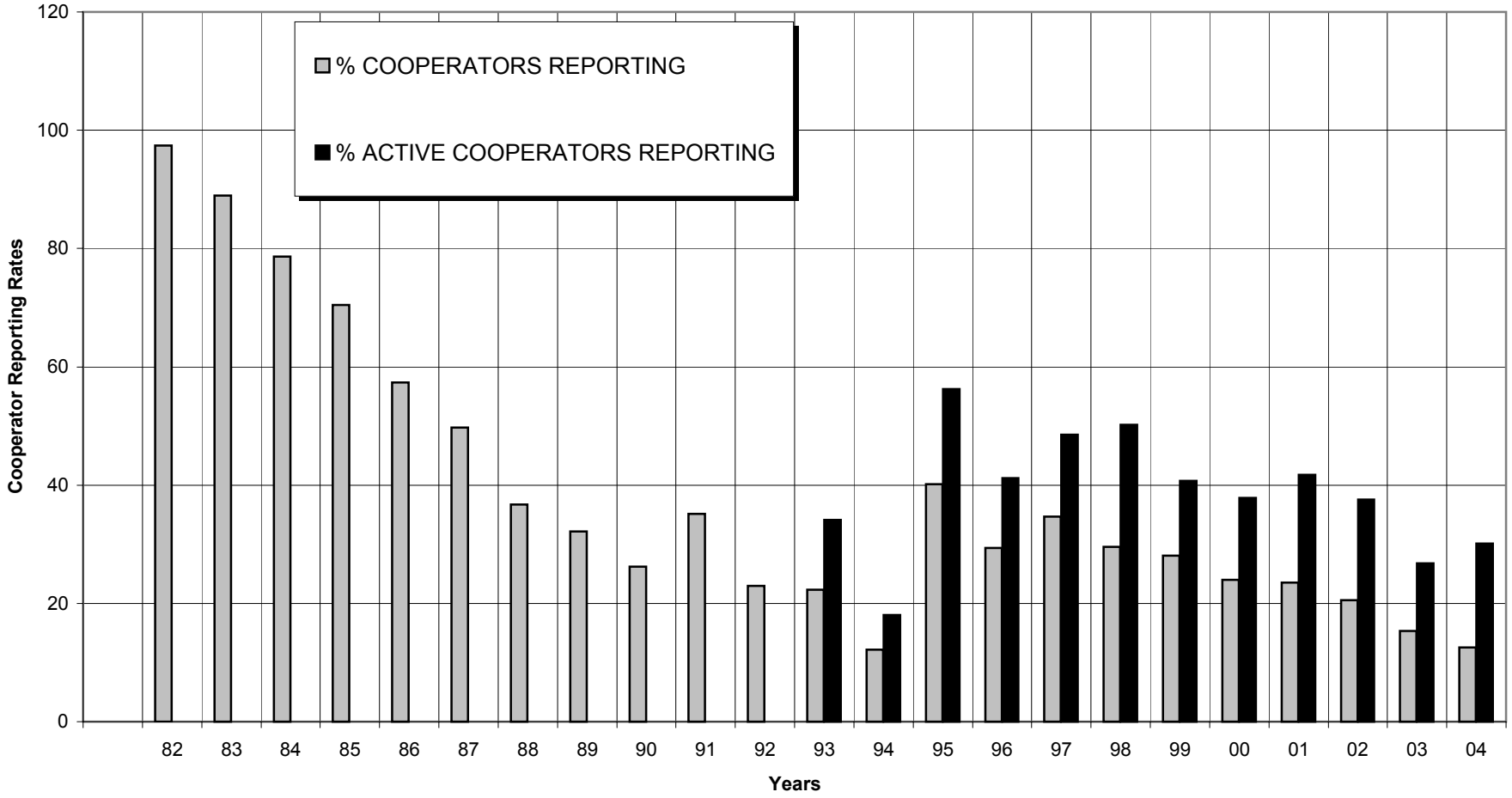


Figure 9. Governor's wood duck project annual minimum reported wood duck production, 1982-2004.

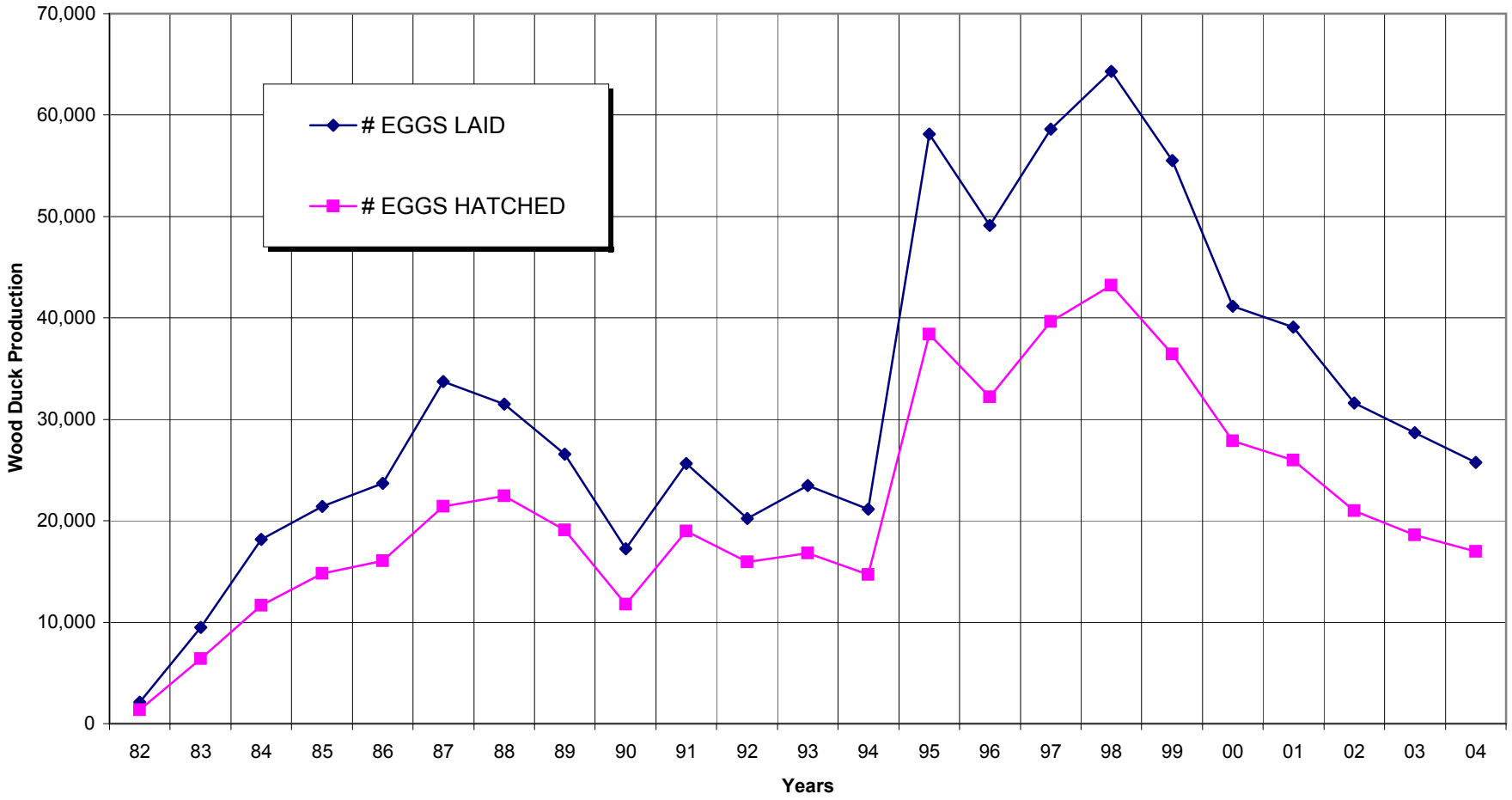
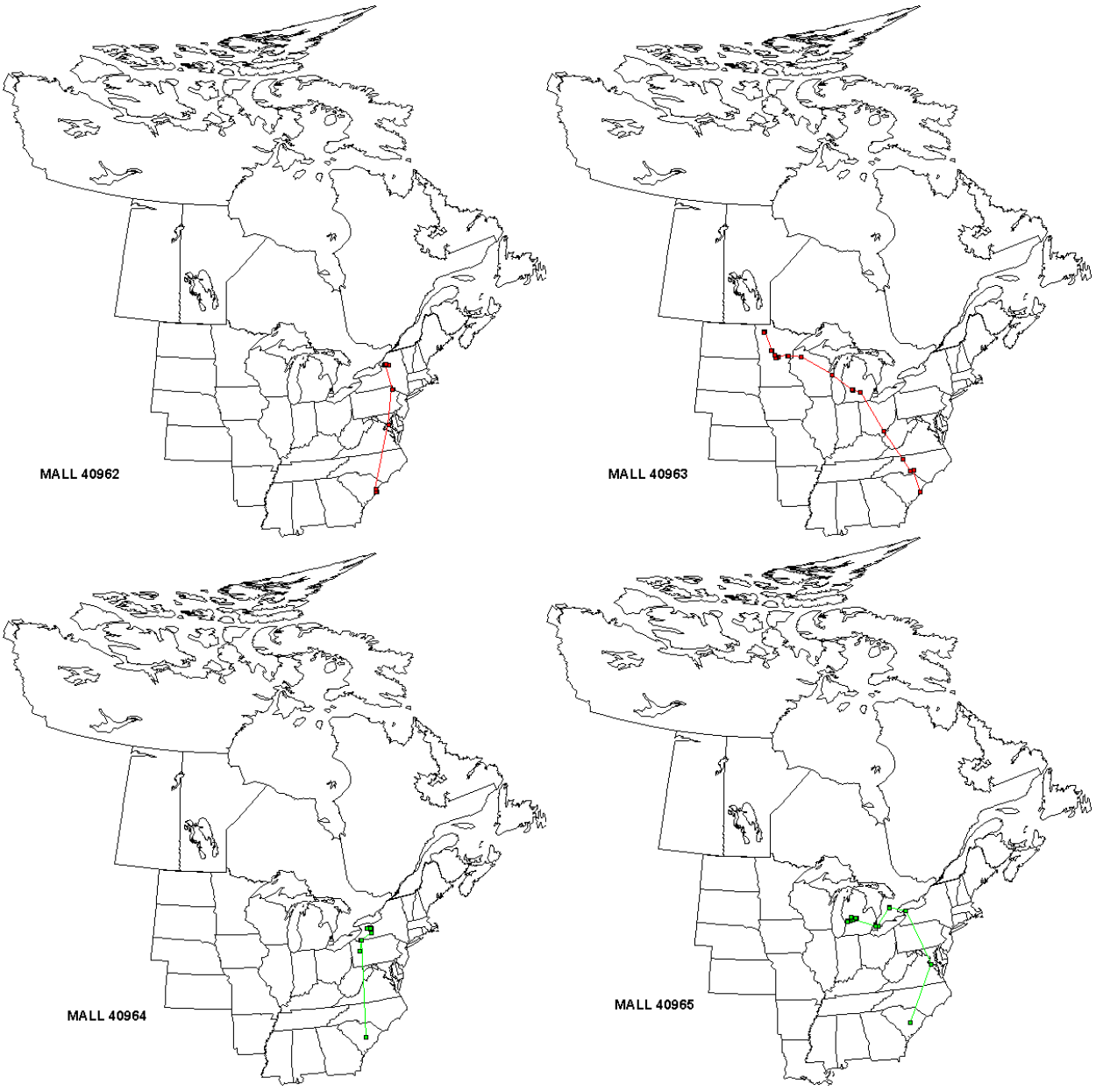
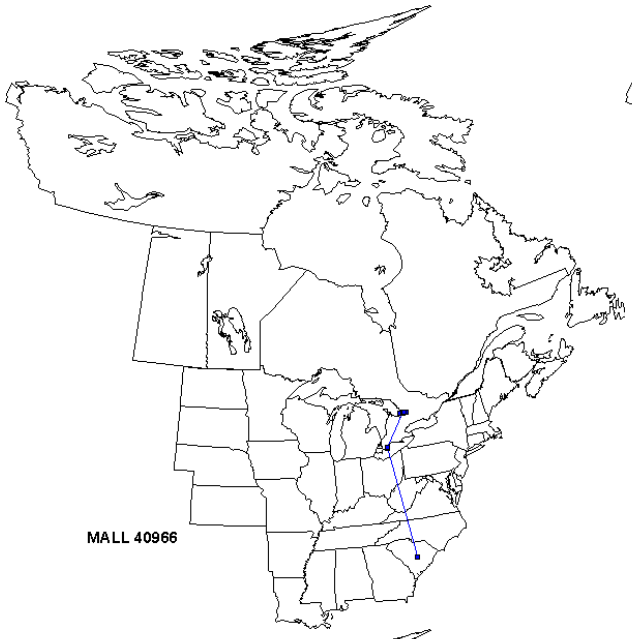
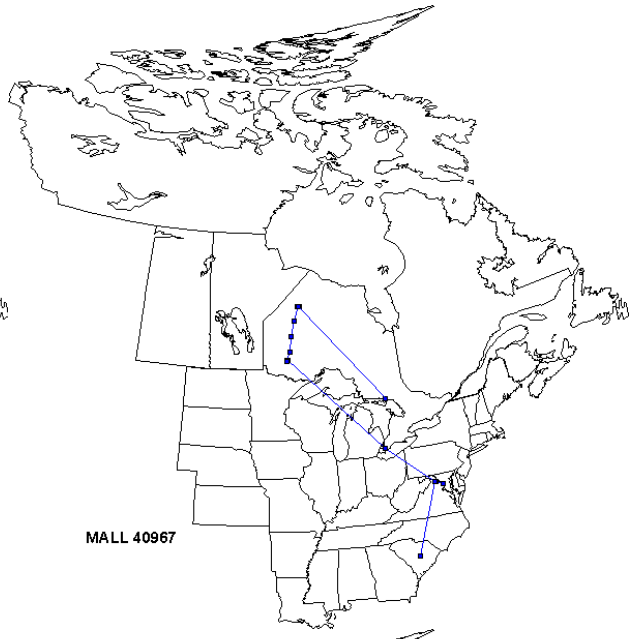
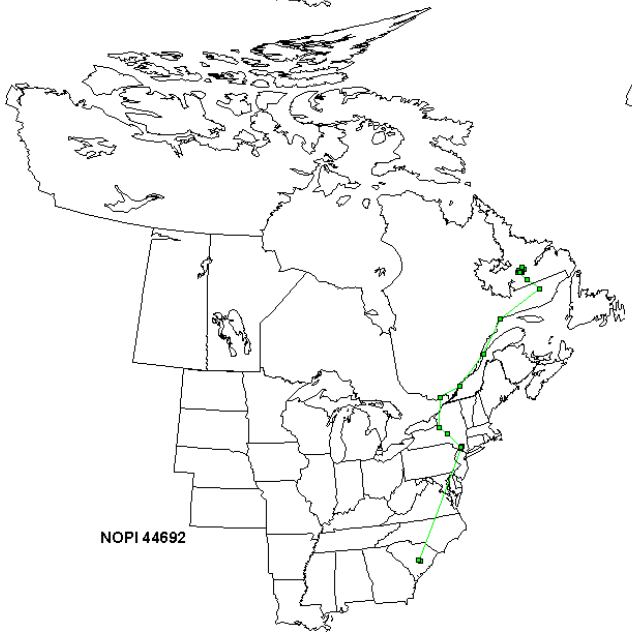


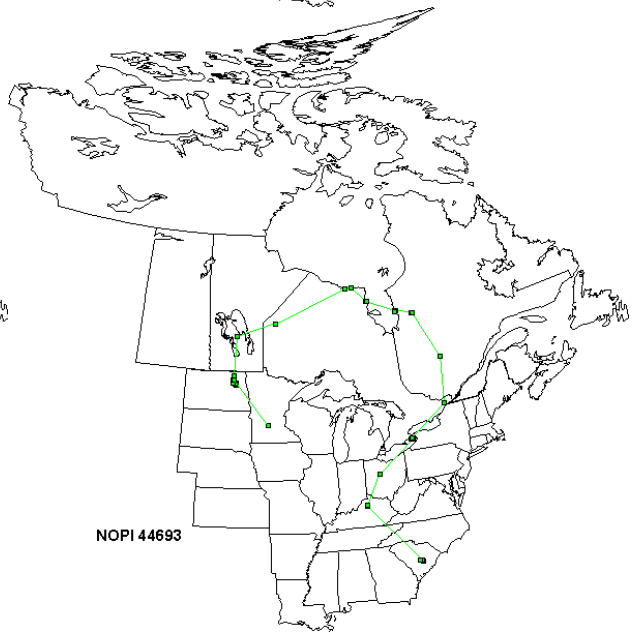
Figure 10. Movement of mallards and Northern pintails marked with satellite transmitters in SC during 2003 and 2004.




MALL 40966


MALL 40967


NOPI 44692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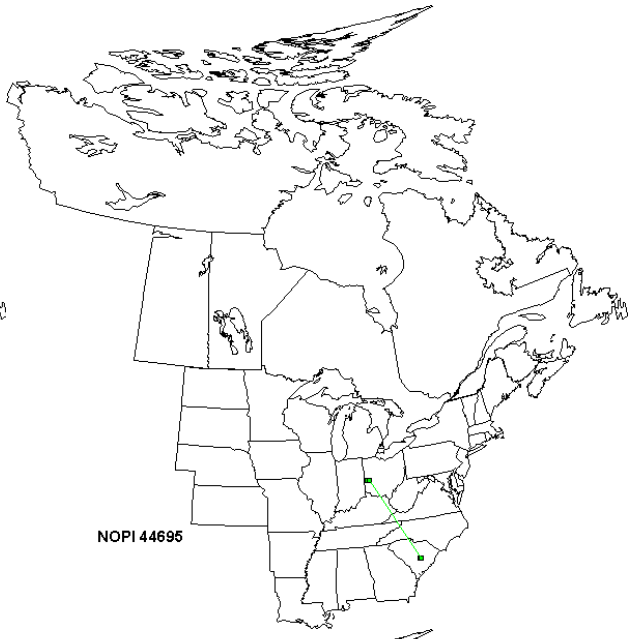
NOPI 44694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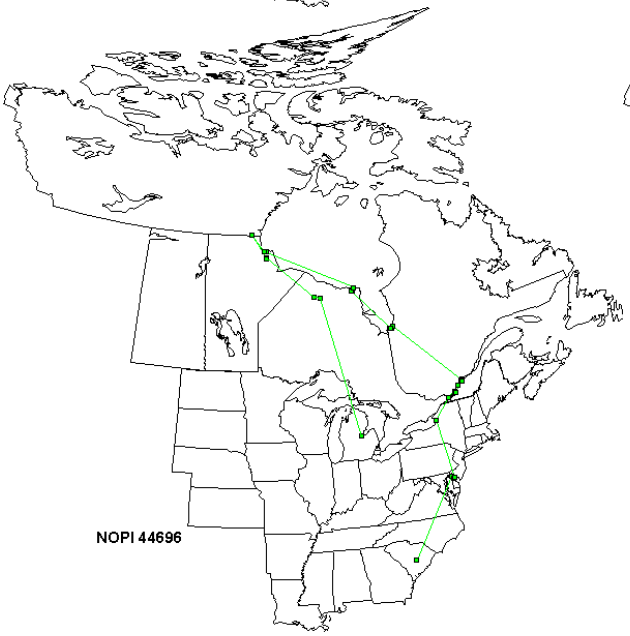
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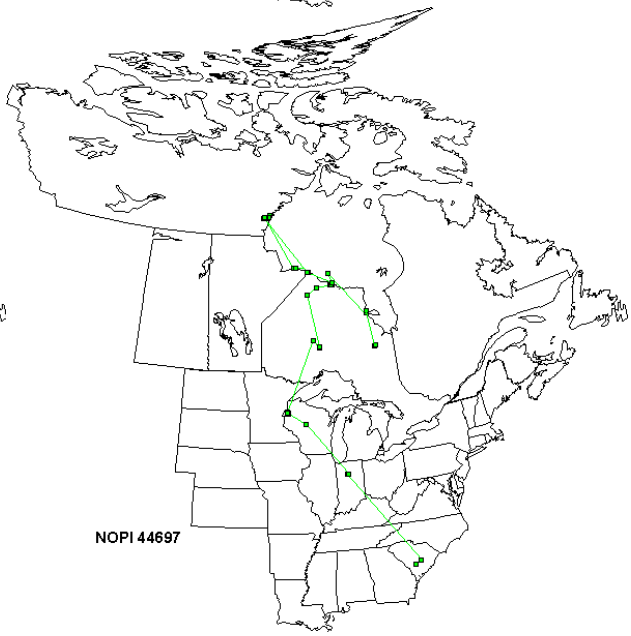
NOPI 44697

NOPI 44698

NOPI 39452 (2003)

Figure 11. South Carolina and Federal duck stamp sales in SC, 1981-82 through 2004-05.